CHANGES IN MACULAR THICKNESS FOLLOWING UNEVENTFUL CATARACT SURGERY

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This is to certify that the dissertation entitled **"CHANGES IN MACULAR THICKNESS FOLLOWING UNEVENTFUL CATARACT SURGERY"** is a bonafide work done by **Dr. M. ABDUL MAJEETH,** Postgraduate student in M.S. (Ophthalmology) during APRIL 2010 to MARCH 2012, under our direct supervision and guidance, at our institute, in partial fufillment for the award of M.S. Degree in Ophthalmology of the Tamilnadu Dr. M.G.R. Medical University, Chennai.

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ABSTRACT

Purpose: To determine changes in macular thickness following uneventful cataract surgery, to elucidate the optical tomographic features of macular thickness after uneventful cataract surgery and to compare the changes in macular thickness following uneventful phacoemulsification and manual small incision cataract surgery.

Methods: A total of fifty patients (28 males and 22 females), ranging in age from 35 to 78 years (mean age 58.6 years) were enrolled in the study. Of these, 25 (50% of total) individuals underwent small incision cataract surgery (SICS) in one eye with "in the bag" polymethacrylate intraocular lens (PMMA IOL) implantation, while the other 25 (50% of total) individuals underwent phacoemulsification in one eye with "in the bag" acrylic type of foldable IOL. Exclusion criteria were cataract too dense for pre-operative OCT, retinal pathology, traumatic or complicated cataract and complication during surgery. Best corrected visual acuity was measured; OCT was done pre and post–operative periods for macular thickness. Follow up of the patients was done at one, two and four weeks after the surgery and also three months after surgery.

Results: In the 50 patients, who underwent cataract surgery, subclinical macular oedema was noted at the first, second and fourth week reviews; the peak subclinical macular odema was noted at the first week review. However, at the third month review, the macular edema had reduced. Highly significant ($P<0.01$) or significant ($P<0.05$) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the preoperative mean value and the post-operative 4th week mean value of macular thickness. In SICS group Highly significant ($P<0.01$) or significant ($P<0.05$) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the preoperative mean value and the post-operative 4th week mean value of macular thickness. In Phaco group Significant ($P<0.05$) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the postoperative 1st week mean value and the post-operative 4th week mean value of macular thickness. There was a significant subclinical

change in the macular thickness without affecting the visual acuity. Cystoid macular edema was not noted in any of the patients in the current study. When both the groups were compared, a prolonged subclinical macular oedema was noted up to the fourth week review in the SICS group whereas in the patients who had undergone phacoemulsification, the macular thickness was found to be increased up to the second week review. However, differences between the two groups in the mean macular thickness values noted preoperatively (`t' (d.f.=48)= 0.96; P>0.05) and at 1 week(`t' (d.f.=48)= 1.06; P>0.05), 2 weeks(`t' (d.f.=48)= 0.73; P>0.05), 4 weeks(`t' (d.f.=48)= 0.62; P>0.05) and 3 months (`t' (d.f.=48)= 0.24; P>0.05)postoperatively were not statistically significant.

Conclusion

Subclinical macular edema occurs after uncomplicated cataract surgery with a peak at 1 week after surgery and can last for up to 4 weeks. OCT showed macular edema without altering the architecture of the macula. The duration of the subclinical edema is longer in eyes undergoing manual SICS as compared to those undergoing phacoemulsification. There is no effect of this edema on visual acuity.

Key words: SICS small incision cataract surgery OCT optical coherence tomography PMMA IOL polymethacrylate intraocular lens

INTRODUCTION

High resolution cross-sectional imaging of the retina is useful for identifying, monitoring and quantitatively assessing macular thickness. Optical coherence tomography (OCT) is a medical diagnostic imaging technology which can perform micron resolution, cross sectional or tomographic imaging in biological tissues. Cross-sectional images of the retina are obtained at the resolution of 10 microns. OCT uses low coherence or white light-interferometry to perform high resolution measurements and imaging. The infra red light beam has a wave length of 820nm. Post-operative changes in macular thickness occur following cataract surgery. Subclinical changes in macular thickness, without affecting visual acuity occur and these changes can be assessed by OCT.[1] Pseudophakic cystoid macular edema (PCME) is a common complication of cataract and intraocular lens (IOL) surgery, manifesting as effusion of fluid from the capillaries. Cystoid spaces form in the macula due the accumulation of serous fluid in the outer plexiform layer. This phenomenon is most often self-limiting, culminating in spontaneous resolution, but occasionally leads to marked impairment of central vision, which may become chronic or permanent.

Anatomy of the macula

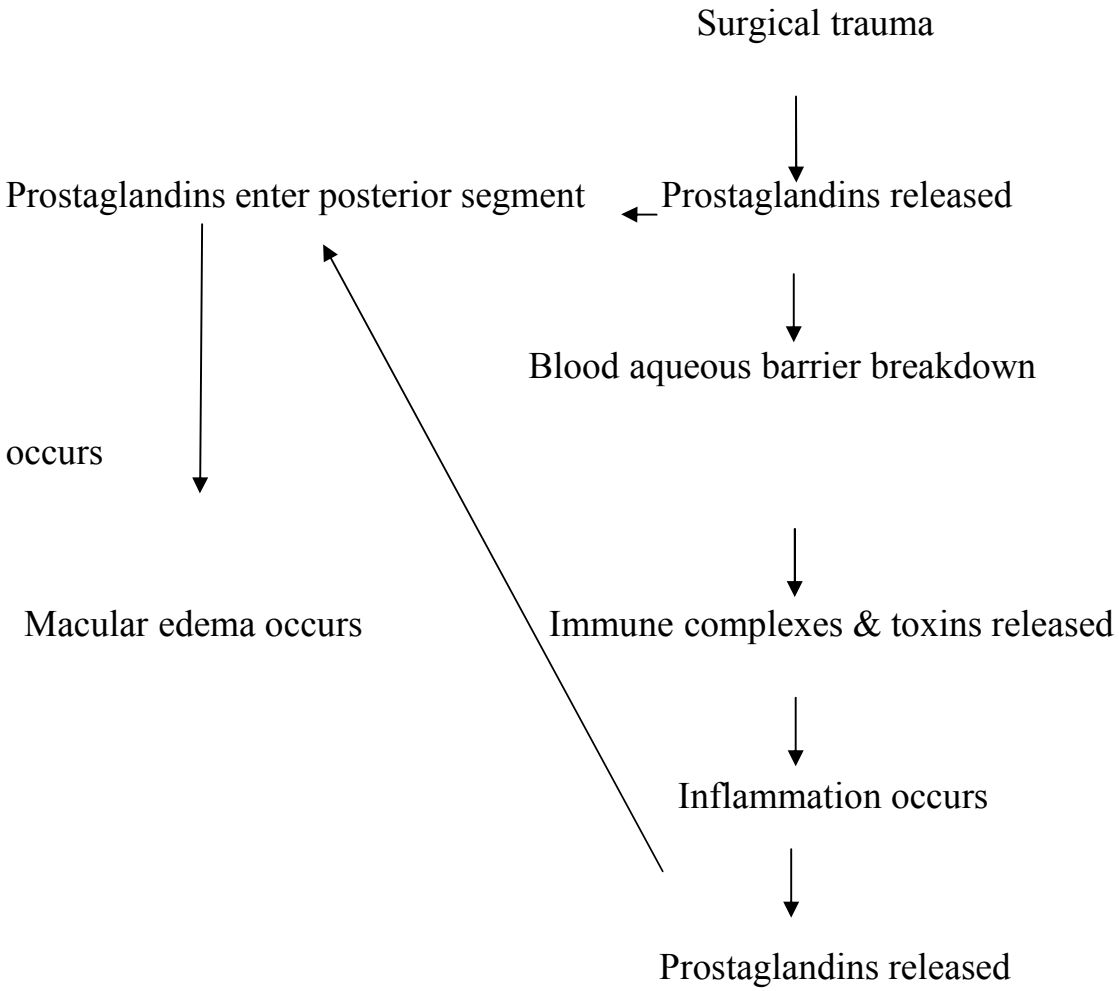
The retina is divided into two regions, namely, a central area measuring 5 to 6 mm and a peripheral large area surrounding it. The central area, the area centralis,[2] a more vague areal concept, is the macula lutea.[3] The macular area is elliptical, being slightly less in the vertical than in the horizontal direction .The transverse diameter of the intensely pigmented central portion is estimated to be 3mm.[4] The surrounding, faintly yellow zone, is about 1mm wide, the diameter of the entire area thus being 5mm. The central area itself can be divided into three areas, the central fovea and two concentric bands surrounding it, the parafovea and the perifovea. The fovea is a shallow rounded pit. The fovea centralis is on the temporal side of the optic disc and about is 0.8mm[5]; its shape is that of a shallow bowl with a concave floor. In the centre of the floor is a slight dip, the foveola,[6] in the midst of which is a small central concavity, the umbo. The parafovea is a belt 2.1 mm wide around the fovea while the perifovea forms a further belt about 1.5mm.

Etiopathogenesis

A break in the blood- aqueous barrier has been identified as the prime cause of PCME. There is breakdown of the junction complexes of the parafoveal capillaries, allowing leakage of the fluid and resultant

oedema. Occurrence of cystoid macular oedema (CME) is related to the synthesis of prostaglandins and other mediators.[7, 8] Surgical trauma leads to release of prostaglandins, which causes a break in the blood- aqueous barrier,[9] with resultant release of toxins and immune complexes (Fig 1). Prostaglandins pass through the vitreous into the posterior segment and result in outpouring of serous fluid into the Henle's layer. Increased levels of prostaglandin E (PGE) and prostaglandin F2 (PGF2) have been demonstrated in patients with CME undergoing vitrectomy. Vitreous fibers are seen to course from the anterior vitreous to a set of holes in the posterior vitreous over the macular area and the optic nerve through which PGEs are thought to diffuse. The primary cause of CME is the leakage of fluid that is low in lipid and protein content from the perifoveal capillaries into the extra cellar spaces due to breakdown of the blood-aqueous barrier.[10]

Fig.1 Schematic representation of the etiopathogenesis of cystoid macular oedema



Occurrence of CME is related to the synthesis of prostaglandins and other mediators. Surgical trauma leads to release of prostaglandins which causes breakdown in the blood-aqueous barrier with resultant release of toxins and immune complexes. Prostaglandins pass through the vitreous into the posterior segment and result in outpouring of serous fluid in the Henle's layer.

Risk factors

The following features have been identified as being risk factors for PCME namely:

a) Age: Younger patients are more prone to develop PCME.[11]

b) CME in the fellow eye: The incidence of clinically significant CME in the fellow eye when one eye has had this complication is reported to be as high as 50%.[12]

c) Race: A lower incidence in blacks has been reported.[12]

d) Diabetes mellitus: Diabetics seem more prone to develop PCME. The incidence of clinical CME in diabetes is reported to be 9.3%, and its average period of presentation to be 3 to 6 months after surgery.[13]

e) Systemic disorders: Patients with vascular diathesis, chronic alcoholism, rosacea and telangiectasia are reported to be at risk of developing PCME.[11]

f) Epinephrine in infusion: It is not clear whether the use of epinephrine in the infusion fluid makes the eye prone to the development of PCME.

g) Irrigation solution: Fluorophotometric evaluation of the blood- ocular barrier function following implant surgery reveals that physiological saline

produces more severe damage to the blood aqueous followed by Ringer lactate solution and balanced salt solution.[14]

h) Exposure to microscope light: Increase exposure to microscope light and increase in the operating time.

Preventive measures

Several measures have been described to prevent PCME, including;

a) Bag fixation of intraocular lens;[15]

b) Avoiding posterior capsulotomy;

c) Use of ultraviolet (UV) filters[16] and ultraviolet (UV) absorbing intraocular lenses;[17, 18]

d) Minimizing exposure to the microscope light;[19]

e) Use of prophylactic steroids in high risk cases; [12, 20, 21] and

f) Minimizing operation time[19]

Although improved surgical techniques have decreased the incidence of PCME, it remains a cause of unfavorable visual outcome following surgery ; moreover, there is a paucity of data related to changes in macular thickness following uneventful cataract surgery of different types. Fundus fluorescein angiography has been the gold standard for

diagnosis of subclinical PCME, but non-invasive cross-sectional imaging of the retina by OCT may also effectively detect the condition and has the added advantage of quantification and repeat results. Hence, in the present dissertation, an attempt has been made to study these aspects of PCME.

AIM OF THE STUDY

1. To determine changes in macular thickness following uneventful cataract surgery.

2. To elucidate the optical tomographic features of macular thickness after uneventful cataract surgery.

3. To compare changes in macular thickness occurring following uneventful phacoemulsification and manual small incision cataract surgery.

REVIEW OF LITERATURE

Sourdille et al.[22] evaluated macular thickness changes after uneventful cataract surgery using OCT and compared these with measurement of flare and cells of the anterior chamber. Forty-one eyes having uneventful cataract surgery with clear corneal incision with foldable intraocular lens were evaluated by OCT and followed at 1 ,8, 12 , 30 and 60 days postoperatively. Clinical and subclinical thickness changes without breakdown of the blood aqueous barrier could be detected after cataract surgery and most of these resolved spontaneously; this was not related to a higher quantum of postoperative flare.

Von jogow et al.[23] used standardized OCT to find subclinical changes in macular thickness postoperatively. Thirty-three patients without macular pathology in both eyes were examined; the contralateral eye served as control. All patients underwent phacoemulsification with intraocular lens (IOL) implantation. Axial length, anterior chamber depth, phaco time and phaco energy were noted. Postoperative macular thickness was measured at 1day, one week, and six weeks after surgery. Mean foveal thickness (MFT) was increased significantly at day one. No clinical CME

was diagnosed in this study. After cataract surgery a mild increase of foveal thickness was noted which, however, did not impact visual acuity. Biometric parameters, such as phaco time, phaco energy and axial length, did not correlate with the degree of macular thickness.

Biro et al.[24] found changes in foveal and perifoveal thickness after phacoemulsification and IOL implantation when OCT was used for measurement. Seventy-one eyes underwent phacoemulsification with "in the bag" implantation of foldable IOL under topical anaesthesia. Data were collected one day before surgery and post- operatively on the first, 7th, 30th and 60th day; the contralateral eye served as control. There were no significant changes in thickness at day one. However significant increases in thickness where detected, on the 7^{th} , 30^{th} and 60^{th} days, in the perifoveal 3.0 and 6.0 mm, either calculated alone or averaged together with the foveal values to provide a more accurate description of the postoperative macular oedema. Mild subclinical perifoveal oedema was detected using OCT at 7^{th} postoperative day up to 6 months after surgery. OCT enables detection of minimal increases in perifoveal retinal thickness even 6 months after cataract surgery.

Yazici et al.[25] reported macular thickness changes after phacoemulsification combined with primary posterior curvilinear capsulorhexis. Forty patients under went phacoemulsification and 'in the bag' IOL implantation with primary posterior curvilinear capsulorhexis (PCCC) and without macular pathology before surgery. OCT was performed preoperatively and postoperatively on the 1st day, first week, and first, third and sixth months. The greatest change in mean macular thickness was noted at the first month visit. No patient developed CME because PCCC does not have an adverse effect on macular integrity. Hence, this procedure may be performed in patients with a high risk of posterior capsular opacification.

Lobo et al.[26] assessed macular alteration in 32 patients who underwent uneventful phacoemulsification with foldable IOL. Postoperatively patients were examined at the 3rd, 6th, 12th and 30th weeks. The examination included retinal leakage analysis and OCT. Increase in retinal thickness reached a maximum at 6 weeks in 13 of 32 eyes after which recovery was progressive. At 30 weeks, all eyes had good visual acuity, but 7 eyes still had macular odema. Macular oedema after cataract surgery occurred primarily in the central region of the macula and was

associated with the presence of the leaking sites, which were predominantly in the vascular region of the central macula.

Nakayama et al.[27] studied macular thickness after cataract surgery in diabetic patients. This study sought to evaluate the time course of change in macular thickness in diabetics compared with that of non-diabetic patients after uneventful cataract surgery. Thirty-six diabetic and 30 non-diabetic patients were examined preoperatively and postoperatively on the 1^{st}, 3^{rd}, 7^{th}, 30^{th} , 90^{th} and 180^{th} days. Diabetics had prolonged and progressive macular thickening 6 months after surgery. Changes in non-diabetics improved gradually and returned to near normal within 6 months. These authors found that retinal thickness analysis using the retinal thickness analyzer (RTA) is useful for early detection of macular oedema. These authors concluded that while cataract surgery induced subclinical macular oedema even in non-diabetic subjects, progressive macular edema might cause poor visual outcome in diabetic patients.

Jurecka et al.[28] demonstrated macular thickness changes after uncomplicated cataract surgery measured by means of OCT to specify the incidence of CME. One hundred patients underwent uneventful phacoemulsification with “in the bag” IOL implantation. Phacoemulsification time and total duration of the surgery were noted.

OCT examination was performed preoperatively and postoperatively on the 1st day, at the 1stweek and during the 1st, 2nd, 3rd and 6th months. The increase in the retinal thickness and macular volume reached the maximum in the 1st and 2nd month, and decreased after 3 months. There was a positive statistical correlation between the increase in retinal thickness and the real phacoemulsification time as well as between the increase in retinal thickness and the overall duration of the surgical procedure .The incidence of CME was 3%, but clinically significant CME was detected in 1% of the cases. Topical application of non-steroidal anti-inflammatory drugs effectively prevented the development of CME after an uneventful cataract surgery.

Sambuddha Ghosh et al.[29] compared macular thickness following uncomplicated phacoemulsification with foldable acrylic lens and small incision cataract surgery (SICS) with non-foldable polymethylmethaacrylate lens. Two hundred and twenty-four patients underwent phacoemulsification and SICS by a simple1:1 randomization. Macular thickness was measured by OCT on the 1st,7th, 42nd, and 180th postoperative days. In spite of increased postoperative inflammation following SICS, there was no evidence of CME either clinically or on

OCT; however subclinical increase in macular thickness was greater following SICS compared to phacoemulsification.

MATERIALS AND METHODS

In the view of the variable results reported by investigators, an attempt has been made in the present dissertation to determine changes in macular thickness and to elucidate the OCT features of macula after uneventful cataract surgery performed by SICS and by phacoemulsification.

This study was performed at Joseph Eye Hospital, institute of ophthalmology, Trichy.

A total of fifty patients who underwent cataract surgery (28 males and 22 females), ranging in age from 35 to 78 (mean age 58.6 years) were enrolled in the study.

Inclusion criteria

Patients were enrolled in the study if they satisfied the following criteria:

a) Cataract allowing pre operative OCT to be performed

b) Patients without retinal or macular pathology

c) Patients who underwent uneventful cataract surgery

Exclusion criteria

Patients were excluded from the study if the following were noted:

a) Mature cataract

b) Traumatic cataract

c) Complicated cataract

d) Complication during surgery.

e) Retinal pathology.

Examination of patient

A complete ocular examination was done for all patients. Examination was done pre-operatively, per-operatively and post-operatively.

a) **Pre operative examination consisted of the following:**

1. Determination of best corrected visual acuity by Snellen's chart;
2. Slit lamp examination of the anterior segment;
3. Slit lamp biomicroscopy of the fundus using + 90D lens;
4. Fundus photography; and
5. OCT fast macular scan, line scans through the fovea, retinal thickness analysis and retinal map analysis.

Other routine examinations included determination of the:

1. Intraocular pressure (IOP) by applanation tonometry;
2. Patency of the naso-lacrimal duct by syringing;
3. Axial length using the IOL master, and;
4. General examination

b) **Per- operative examination consisted of noting the following points:**

1. Type of surgery, namely phacoemulsification or SICS;
2. Total duration of the surgery, and the actual phacoemulsification time; and
3. Absence of surgical complications.

c) **Post - operative examination included the following:**

1. Determination of the best corrected visual acuity;
2. Slit lamp examination of the anterior segment;
3. Slit lamp biomicroscopy of the fundus using +90D lens;
4. Fundus photography; and
5. OCT macular scan.

Surgical technique

Patients underwent Phacoemulsification using a 2.8 mm superior or superotemporal scleral tunnel incision with a divide and conquer technique. A foldable acrylic intraocular lens was inserted in the capsular bag at the end of surgery.

Patients underwent manual small incision cataract surgery using a 6.0 or 6.5 mm superior or superotemporal scleral tunnel incision. Nucleus was removed using the sandwich technique. A 6.0 mm PMMA single piece rigid intraocular lens was implanted in the bag at the end of surgery.

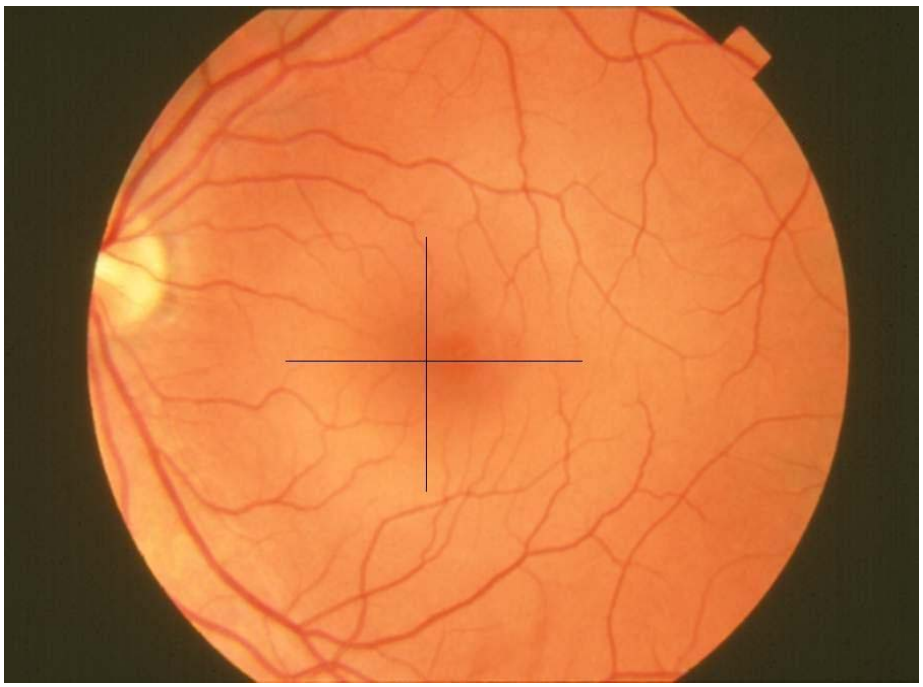
Follow up of the patients was done at one, two and four weeks after the surgery and also three months after surgery.

Examination of the patient's eyes by OCT

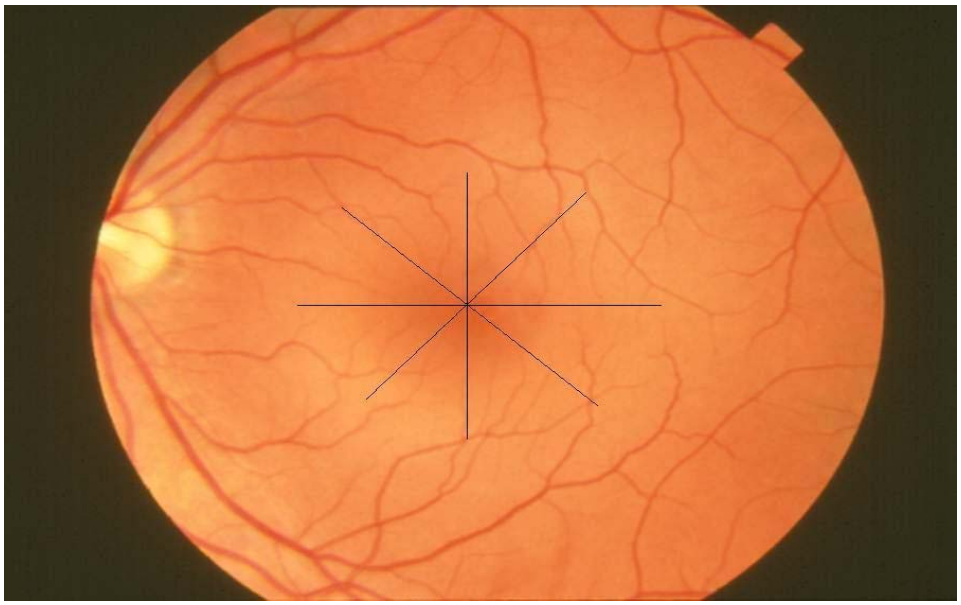
Each eye of each subject was dilated with 1% tropicamide and 5% phenylephrine hydrochloride before recording the image. The patient was seated comfortably in front of the OCT machine (Zeiss Stratus 3) with chin positioned on the chin rest, and was asked to fixate on the fixation target. The internal fixation (green colour light) target was the commonly used fixation target. After fixation, the operator selected the

desired scan (Raster line scan with length of 5 mm in horizontal and vertical axis; Fast macular scan protocol) and aligned the instrument so that the fundus image and scan beam were displayed on the screen. In patients with significant refractive errors, rotation of the dioptre compensation device was found to improve image quality. Retinal thickness was quantitated by the computer for each scan in the image as the distance between the first reflection at the vitreoretinal interface and the anterior boundary of the red, reflective layer corresponding to the retinal pigment epithelium and choriocapillaries. Besides retinal thickness, retinal architecture with presence of any retinal edema, cystoid spaces, hard exudates and sub-retinal fluid were specifically looked for.

Picture showing line scan protocol



Picture showing Fast macular scanning



Interpretation of the OCT scans

The reflectivity pattern of the scanned images was studied**.**

a) Hyperreflectivity patterns: suggested the following:

1) Hard exudates;

2) Hyperreflective shadows in the neurosensory retina that completely blocked the reflections from the underlying retina.

Blood: If a thin layer, this was hyperreflective whereas a thick layer was found to block the underlying reflections and

3) Scar tissue and neovascular membranes (showed varying Hyperreflectivity);

b) Hyporeflective patterns were presumed to suggest the following:

1) Serous fluid;

2) Optically empty space with absence of backscattering; and

3) Cystoid spaces in the retina.

RESULTS

This study was conducted at a tertiary eye care hospital in Tiruchirapalli, Tamilnadu over a period of 12 months (from August 2010 to August 2011). Based on the defined inclusion and exclusion criteria, 50 individuals (28 [56%] males and 22[54%] females were enrolled in the study. The age of the patients (Fig. 2a) ranged from 35 to 78 years [mean age 58.36 ±10.23 years {95% confidence interval (C.I.) = 55.45 to 61.27 years}]. Of these, 25 (50% of total) individuals underwent small incision cataract surgery (SICS) in one eye with "in the bag" polymethacrylate intraocular lens (PMMA IOL) implantation, while the other 25 (50% of total) individuals underwent phacoemulsification in one eye with "in the bag" acrylic type of foldable IOL. The surgeries on these individuals were performed by three experienced surgeons.

1. Age of patients

The mean age of the 25 patients who underwent the SICS procedure was 57.04 ± 8.05 [95% C.I.= 53.72 to 60.36] years (Fig. 2b) while the mean age of the 25 patients who underwent the phacoemulsification procedure was 59.68 ± 12.05 [95 % C.I.= 54.71 to 64.65] years (Fig. 2c);

this difference was not statistically significant (`t' test [degree of freedom {d.f.}=48] = 0.9110 ; P = 0.37).

2. Gender of the patients

In the SICS group, there were 10 males and 15 females while in the phacoemulsification group, there were 12 males and 13 females; this difference was not statistically significant (λ_2 (d.f.=1)= 0.38; P > 0.05) (Fig. 3).

3. Conditions associated with cataract in the patients and laterality of the operated eye

Forty-three (86 %) of the 50 patients did not have any systemic illness. Seven (14%) of the 50 patients suffered from hypertension; one of these hypertensive patients underwent SICs while the other six hypertensive patients underwent phacoemulsification.

The right eye was operated on in 25 of the 50 patients while the left eye was operated on in the other 25 patients. In the SICs group, the right eye was operated on in 11 patients and the left eye was operated on in 14 patients, while in the phacoemulsification group, the right eye was operated on in 14 patients and the left eye was operated on in 11 patients;

this difference was not statistically significant (λ_2 (d.f.=1)= 0.72; P > 0.05) (Fig. 4).

4. Duration of ocular surgery in the two groups of patients

Overall, in the 50 patients, the mean surgical time was 10.16 ± 1.04 (95 % C.I. =9.87 to 10.45) minutes (Fig. 5a) . In the 25 patients who underwent SICS, the mean surgical time was 10.0 ± 0.87 (95 % C.I.= 9.64 to 10.36) minutes (Fig. 5b), which was less than the mean surgical time (10.32 ± 1.18 [95 % C.I. = 9.83 to 10.81]) minutes in the 25 patients who underwent phacoemulsification (Fig. 5c); however, this difference was not statistically significant (`t' [d.f.= 48]= 1.09 ; P=0.28) . In the 25 patients who underwent phacoemulsification, the mean phacoemulsification time was 1.28 ± 0.4 minutes (Fig. 5d).

5. Visual acuity in the operated eyes of patients who underwent cataract surgery

In the 50 patients, the mean pre–operative visual acuity was 0.31 ± 0.2 (95 % C.I. = 0.26 to 0.36) decimals (approximately 6/18p) while the mean post-operative visual acuity was 0.68 ± 0.2 (95 % C.I. = 0.63 to 0.72) decimals (approximately 6/9) (Fig. 6a); this difference was statistically significant (`t' [d.f.= 98]= 9.25 ; P <0.0001).

In the 25 patients who underwent SICS, the mean pre-operative visual acuity was 0.21 ± 0.15 (95 % C.I. = 0.15 to 0.27) decimals (approximately 6/36p) while the mean postoperative visual acuity was 0.65 ± 0.17 (95 % C.I. = 0.59 to 0.72) decimals (approximately 6/9) (Fig. 6b); this difference was statistically significant ("t" [d.f.=48]=9.9 ; P <0.0001). In the 25 patients who underwent phacoemulsification cataract surgery, the mean pre-operative visual acuity was 0.40 ± 0.17 (95 % C.I. = 0.33 to 0.47) decimals (approximately 6/18) while the mean postoperative visual acuity was 0.70 ± 0.17 (95 % C.I. = 0.63 to 0.77) decimals (approximately 6/6p) (Fig. 6c); this difference was statistically significant ("t" [d.f.=48]= 6.27 ; P < 0.0001).

Interestingly, the mean pre-operative visual acuity was 0.21 ± 0.15 (95 % C.I. = 0.15 to 0.27) decimals in the 25 patients who underwent SICS and was 0.40 ± 0.17 (95 % C.I. = 0.33 to 0.47) decimals in the 25 patients who underwent phacoemulsification; this difference was statistically significant (`t' [d.f.=48]= 4.20; P=0.0001). However, the difference between the mean post-operative visual acuity in the patients who underwent SICS (0.65 ± 0.17 [95 % C.I. = 0.59 to 0.72] decimals) and the mean post-operative visual acuity in the patients who underwent phacoemulsification (0.70 ± 0.17 [95 % C.I. = 0.63 to 0.77] decimals) was not statistically significant (`t'[d.f.=48]= 0.98; P=0.33).

6. Macular thickness in the operated eyes of patients who underwent cataract surgery

In the 50 patients who underwent cataract surgery, the pre-operative macular thickness noted was 172±27μ. The mean pre-operative macular thickness was 162.66 ± 14.53 (95% C.I.=158.53 to 166.79) μ (Fig. 7a). Post- operatively, the following readings were noted:

a) at the first week review, the macular thickness was 183±31 μ and the mean macular thickness was 173.26 μ ± 13.51(95% C.I.=169.42 to 177.10) μ;

b) at the second week review, the macular thickness was 178±23μ and the mean macular thickness was 171.82μ ± 12.86 (95 % C.I.=168.17 to 175.47) μ;

c) at the fourth week review, the macular thickness was 184 ± 32μ and the mean macular thickness was 168.68 μ ± 14.41(95% C.I.=164.59 to 172.77) μ;

d) at the third month review, the macular thickness was 184±31 μ and the mean macular thickness was 166.12 ± 13.85(95% C.I.=162.19 to 170.05) μ (Fig. 7a).

Statistical analysis of the differences between the 5 mean values (pre-operative, postoperative 1st, 2nd and 4th weeks and post-operative 3rd month) was done by one-way analysis of variance (ANOVA); the differences were found to be statistically significant (Fisher `f' value= 4.792; P=0.001). Post-hoc testing was then done by Tukey's method to determine the significance of intergroup differences. Highly significant (P<0.01) or significant (P<0.05) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2ndt week mean value, and the preoperative mean value and the post-operative 4th week mean value, between the post-operative 1st week mean value and the post-operative 3rd

month mean value, and the post-operative 2nd week mean value and the post-operative 3rd month mean value of macular thickness.

In the 50 patients who underwent cataract surgery, subclinical macular oedema was noted at the first, second and fourth week reviews; the peak subclinical macular odema was noted at the first week review. However, at the third month review, the macular edema had reduced (Fig. 7b).

The baseline (preoperative) macular thickness noted in the 25 patients who underwent SICS was 163±20μ while the mean thickness was 160.68μ ± 10.78 (95% C.I.= 156.23 to 165.13) (Fig. 8a). Post-operatively, the following readings were noted:

a) at the first week review, the macular thickness was 175±18μ and the mean macular thickness was 171.2 μ ± 10.63(95% C.I.=166.81 to 175.59) μ;
b) at the second week review, the macular thickness was 170 ± 15 μ and the mean macular thickness was 170.48 μ ± 11.2 (95 % C.I.=165.86 to 175.10) μ;

c) at the fourth week review, the macular thickness was 180 ± 30μ and the mean macular thickness was 167.4 μ ± 15.02 (95% C.I.=161.2 to 173.6) μ;

d) at the third month review, the macular thickness was 180±30 μ and the mean macular thickness was 165.64 ± 15.01 (95% C.I.=159.44 to 171.84) μ (Fig. 8a).

Statistical analysis of the differences between the 5 mean values (pre-operative, postoperative 1st, 2nd and 4th weeks and post-operative 3rd month) in the patients who had undergone SICS was done by one-way ANOVA; the differences were found to be statistically significant (Fisher `f' value= 2.780; P=0.03). Post-hoc testing was then done by Tukey's method to determine the significance of intergroup differences. Highly significant (P<0.01) or significant (P<0.05) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the preoperative mean value and the post-operative 4th week mean value of macular thickness.

In the 25 patients who underwent SICS, subclinical macular edema was noted at the first, second and fourth week reviews. (Fig. 8b)

In the 25 patients who underwent phacoemulsification, the pre-operative macular thickness was 172±32μ while the mean value was 164.64 ± 17.51 (95 % C.I. = 157.41 to 171.87) μ. Post-operatively, the following readings were noted:

a) at the first week review, the macular thickness was 182 ± 32 μ and the mean macular thickness was 175.32μ ± 15.84 (95% C.I.=168.78 to 181.86) μ;

b) at the second week review, the macular thickness was 175±25μ and the mean macular thickness was 173.16μ ± 14.44 (95 % C.I.=167.72 to 179.12) μ;

c) at the fourth week review, the macular thickness was 172±20μ and the mean macular thickness was 169.96μ ± 13.95 (95% C.I.=164.2 to 175.72) μ;

d) at the third month review, the macular thickness was 169 ± 24 μ and the mean macular thickness was 166.6 ± 12.86 (95% C.I.=161.29 to 171.91) μ (Fig. 9a).

Statistical analysis of the differences between the 5 mean values (pre-operative, postoperative 1st, 2nd and 4th weeks and post-operative 3rd

month) in the patients who had undergone phacoemulsification was done by one-way ANOVA; the differences were not found to be statistically significant (Fisher `f' value= 2.18; P=0.075). Post-hoc testing was then done by Tukey's method to determine the significance of intergroup differences Significant (P<0.05) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the postoperative 1st week mean value and the post-operative 4th week mean value of macular thickness.

In the 25 patients who underwent phacoemulsification, there was a significant subclinical change in the macular thickness at the first and second week follow up (Fig. 9b) without, the visual acuity being affected.

When both the groups (patients who had undergone SICS and those who had undergone phacoemulsification cataract surgery were compared, a prolonged subclinical macular oedema was noted up to the fourth week review in the SICS group whereas in the patients who had undergone phacoemulsification, the macular thickness was found to be increased up to the second week review (Fig. 10),(Fig.11a and b) However, differences between the two groups in the mean macular thickness values noted

preoperatively (`t' (d.f.=48)= 0.96; P>0.05) and at 1 week(`t' (d.f.=48)= 1.06; P>0.05), 2 weeks(`t' (d.f.=48)= 0.73; P>0.05), 4 weeks(`t' (d.f.=48)= 0.62; P>0.05) and 3 months (`t' (d.f.=48)= 0.24; P>0.05)postoperatively were not statistically significant

Cystoid macular edema was not noted in any of the patients in the current study.

Figure 2a. Age (in years) of the 50 individuals enrolled in the study

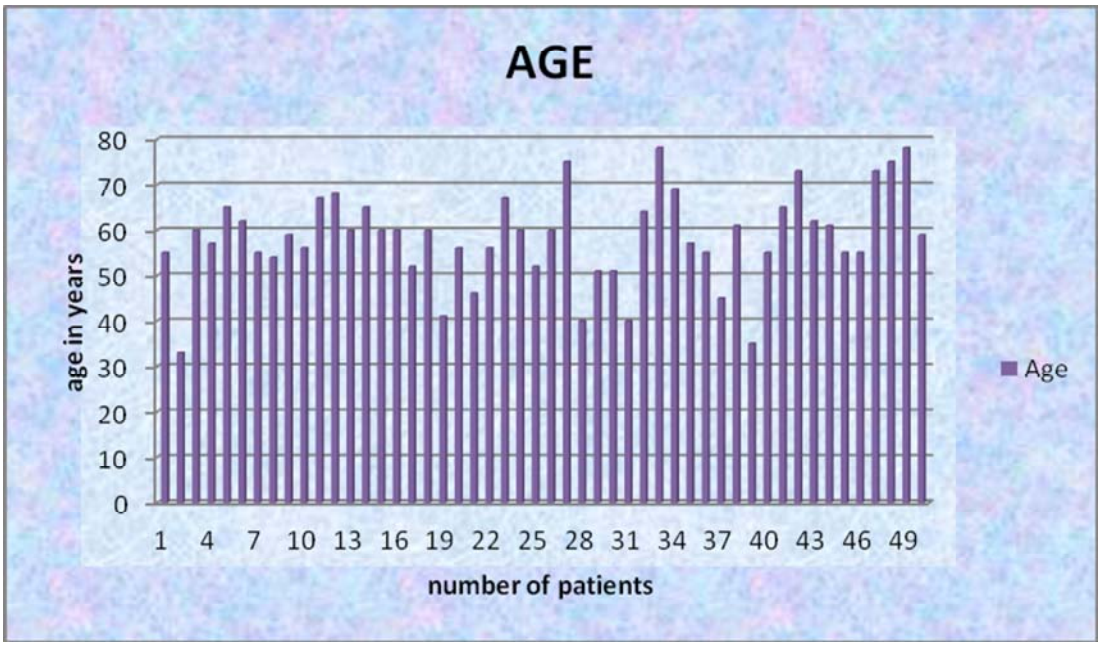


Figure 2b. Age (in years) of the 25 individuals who underwent small incision cataract surgery

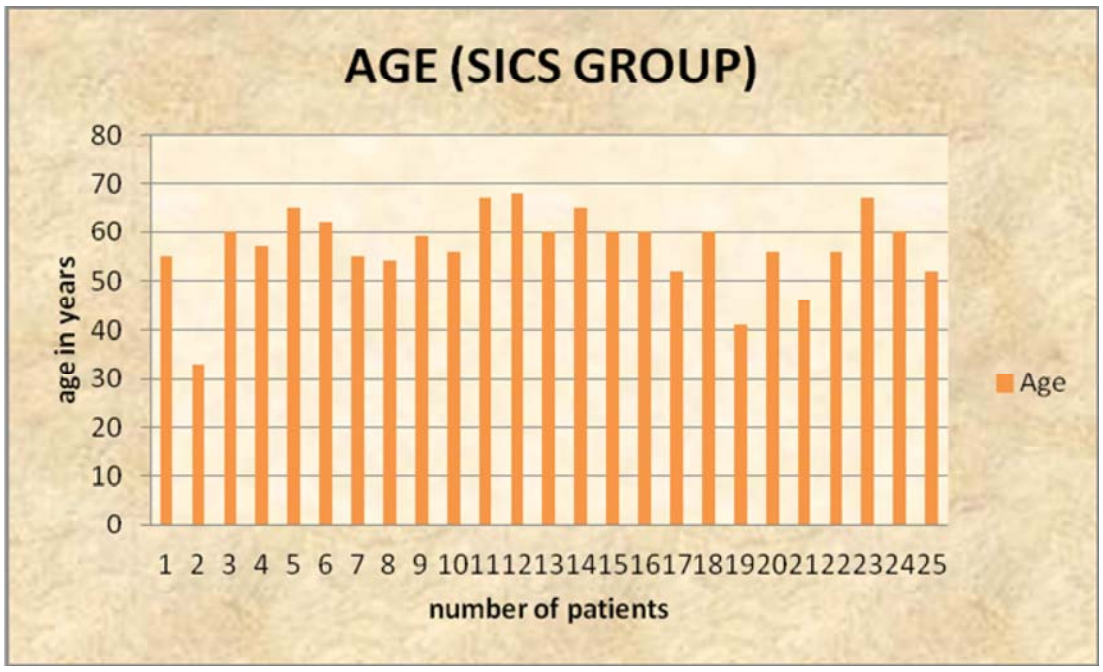


Figure 2c. Age (in years) of the 25 individuals who underwent phacoemulsification cataract surgery

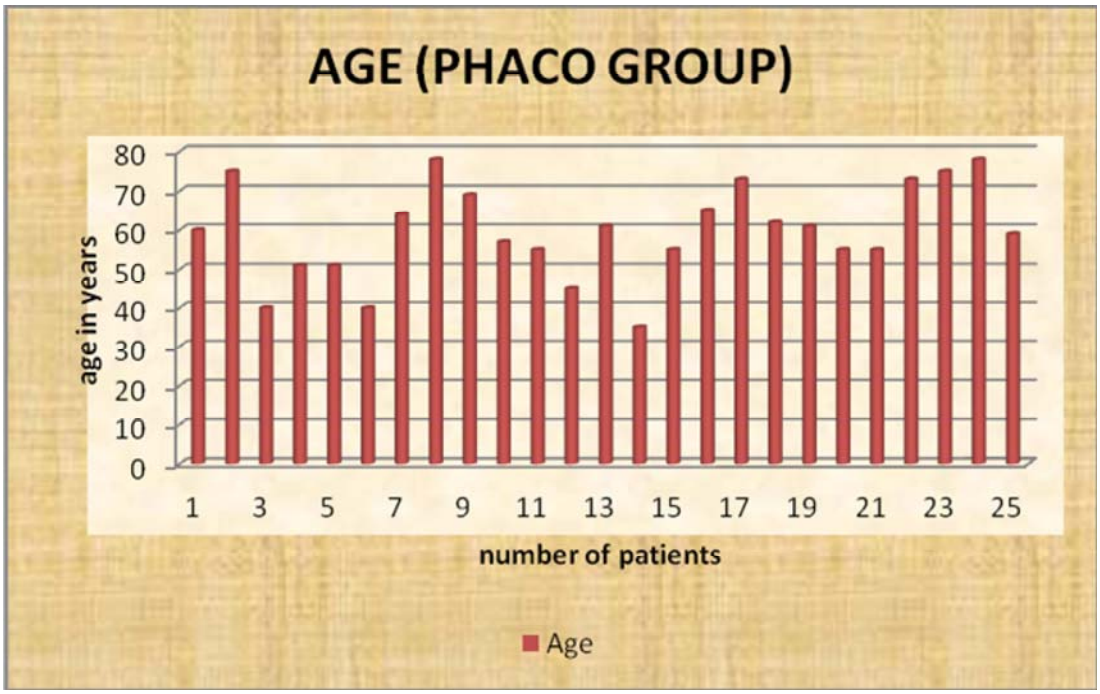


Figure 3. Gender distribution of the individuals enrolled in the study

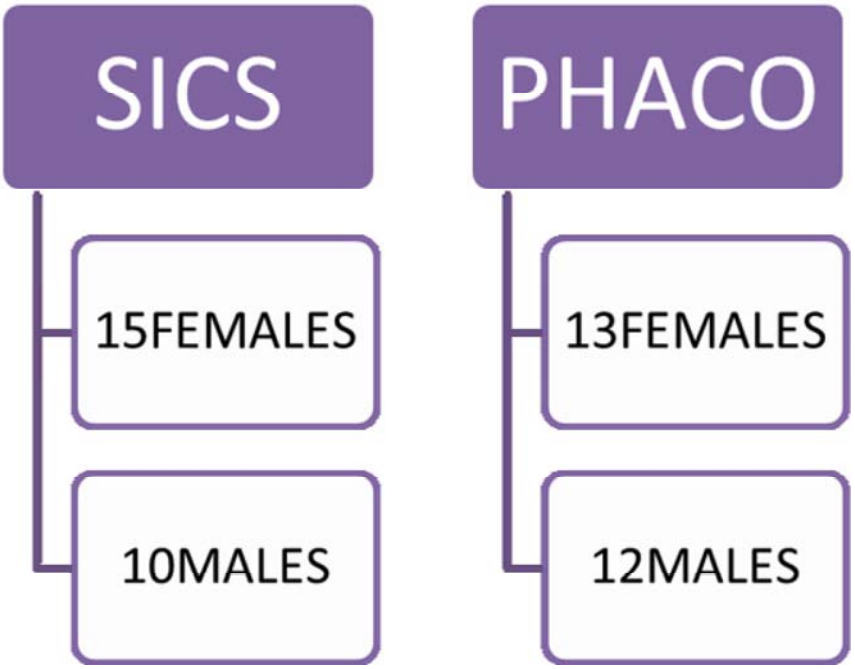


Figure 4. Laterality of the eye operated in the different surgeries

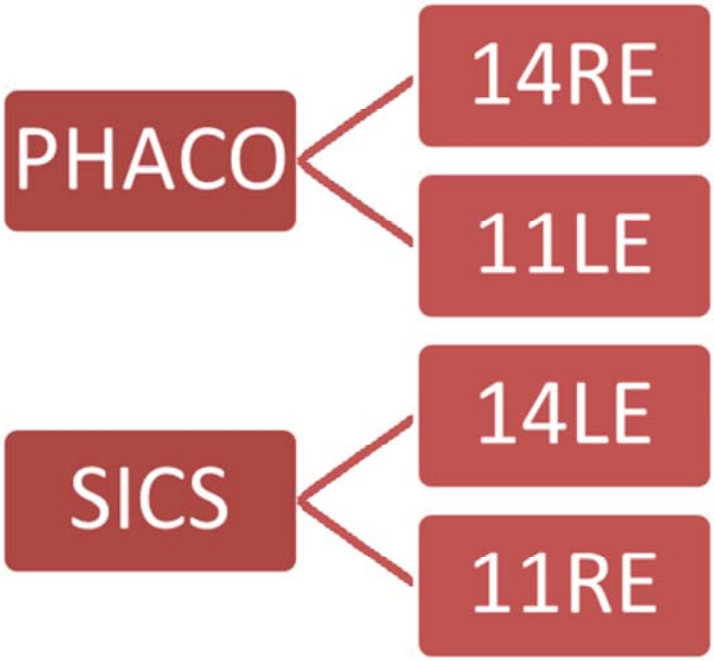


Figure 5a. Duration of surgery (surgical time) in 50 patients who underwent cataract surgery

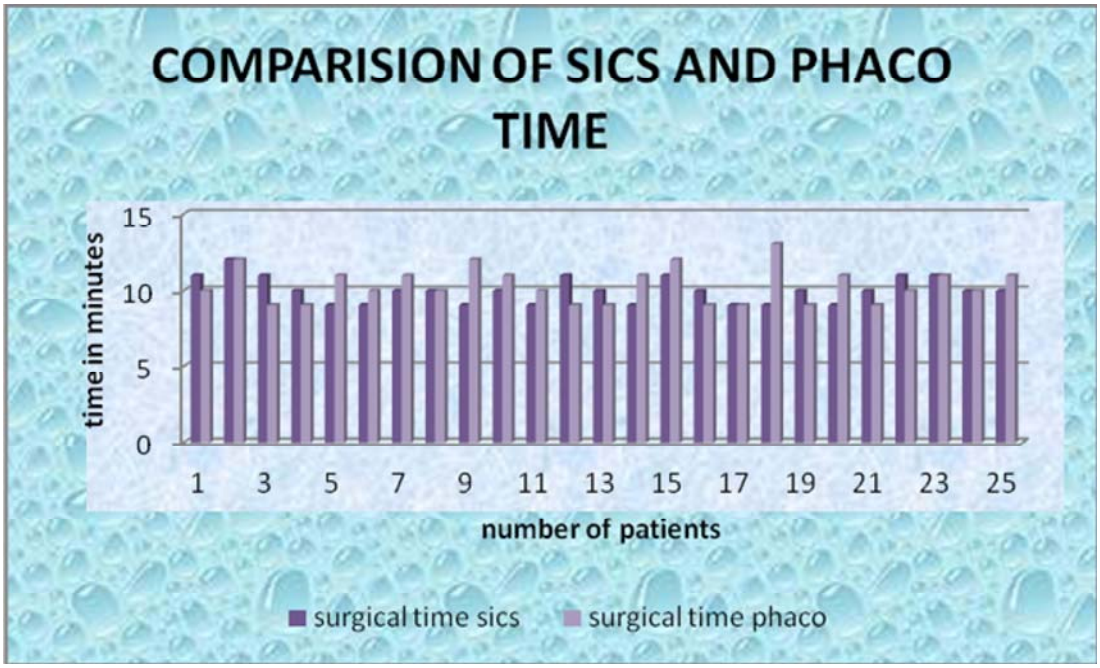


Figure 5b. Duration of surgery (surgical time) in 25 patients who underwent small incision cataract surgery (SICS)

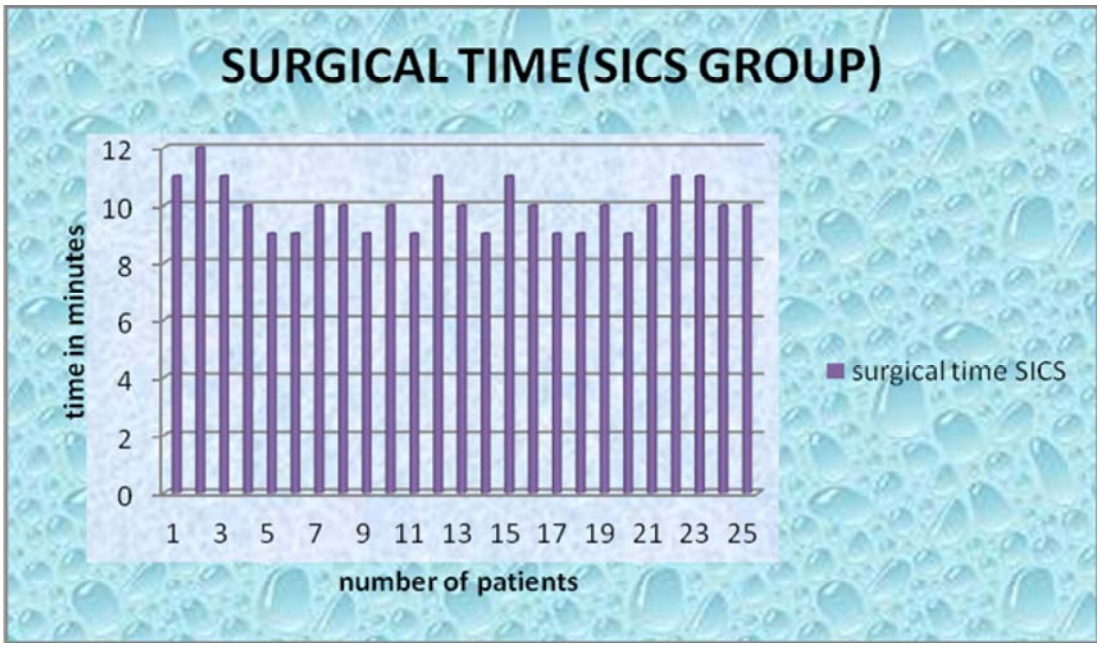


Figure 5c. Duration of surgery (surgical time) in 25 patients who underwent phacoemulsification cataract surgery

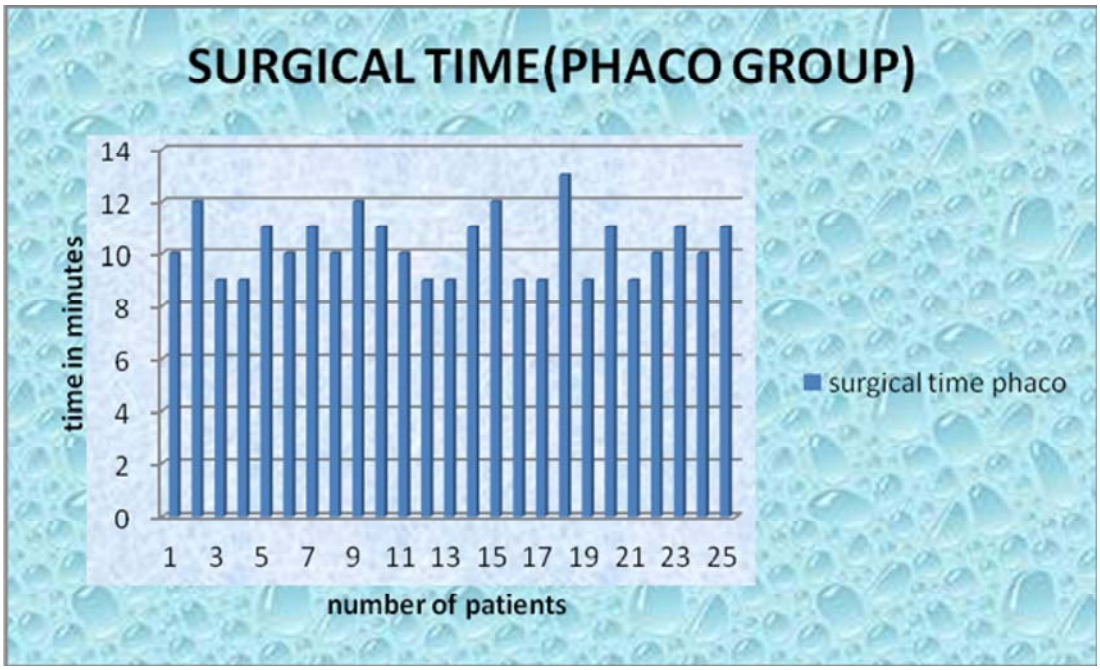


Figure 5d. Duration of phacoemulsification (phaco time) in 25 patients who underwent phacoemulsification cataract surgery

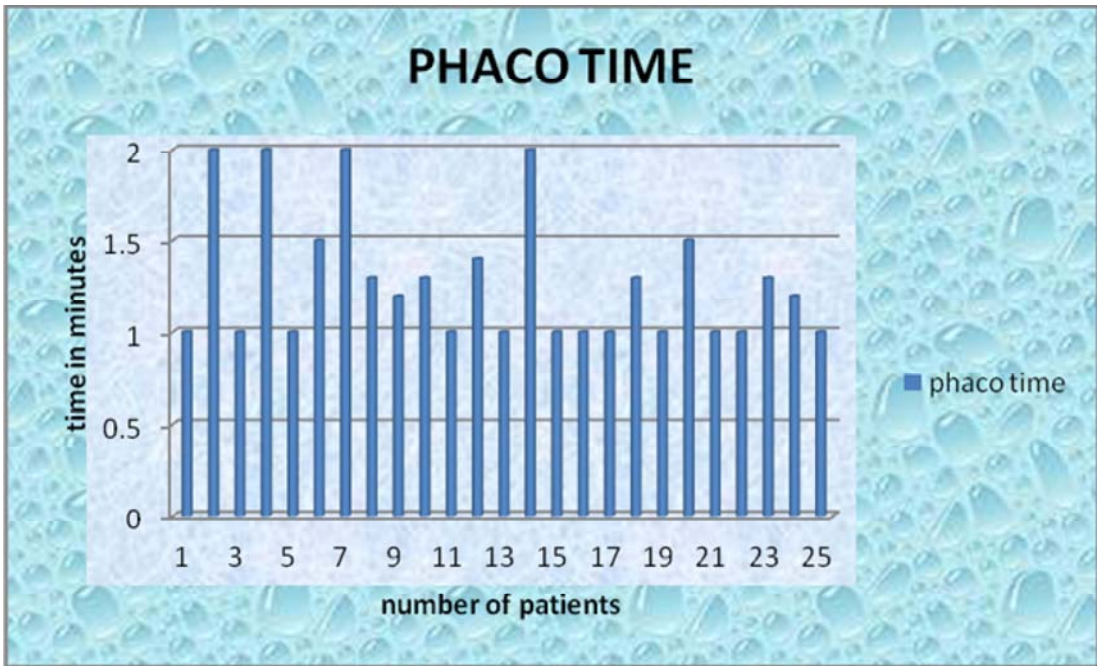


Figure 6a. Pre-operative and post-operative visual acuity in 50 patients who underwent cataract surgery

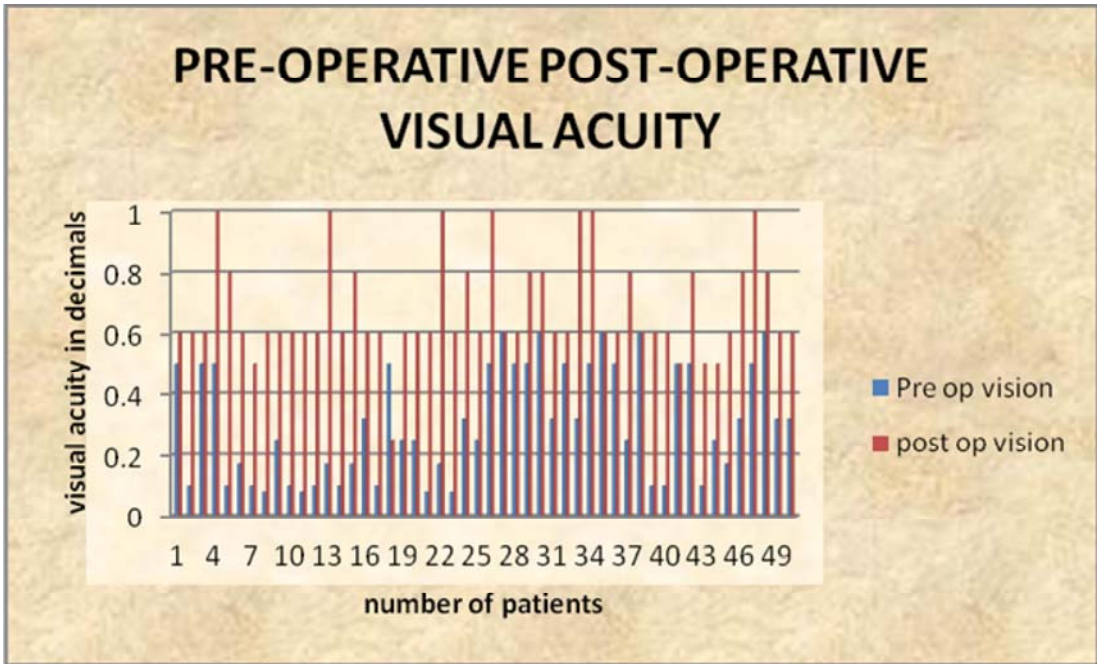


Figure 6b. Pre-operative and post-operative visual acuity in 25 patients who underwent small incision cataract surgery

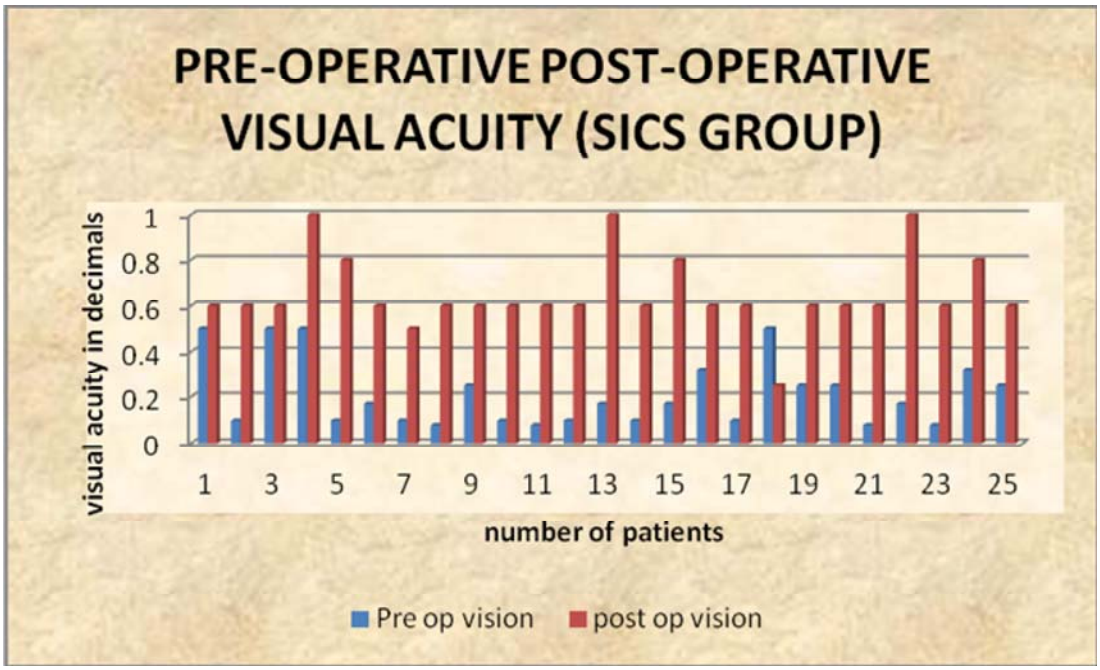


Figure 6c. Pre-operative and post-operative visual acuity in 25 patients who underwent phacoemulsification cataract surgery

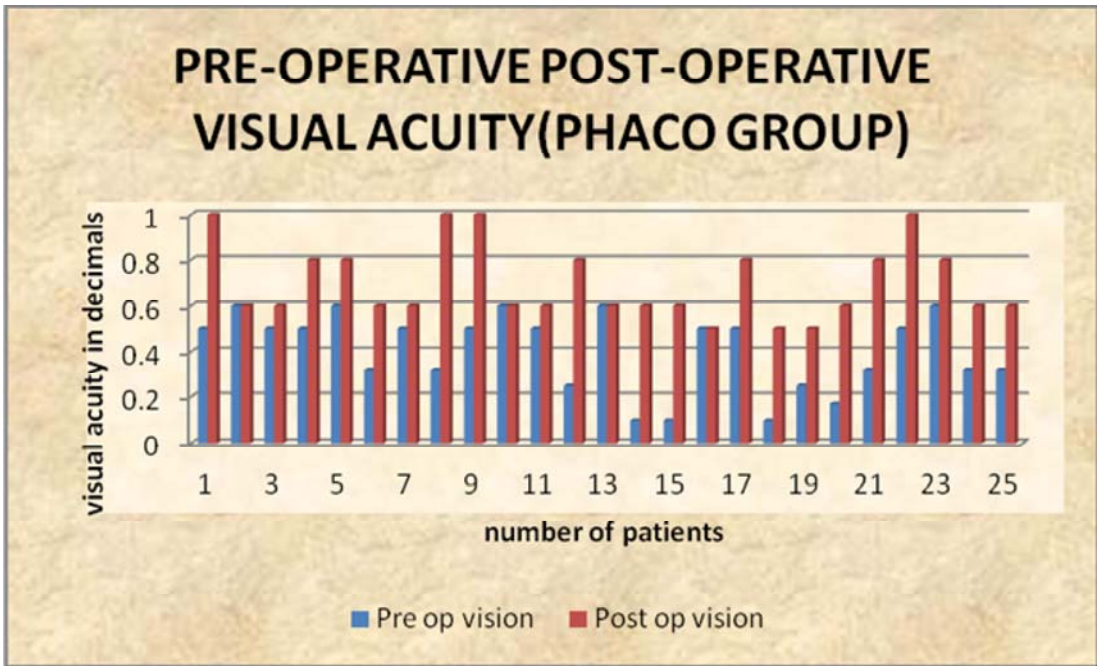


Figure 7a. Preoperative and post-operative macular thickness in 50 patients who underwent cataract surgery

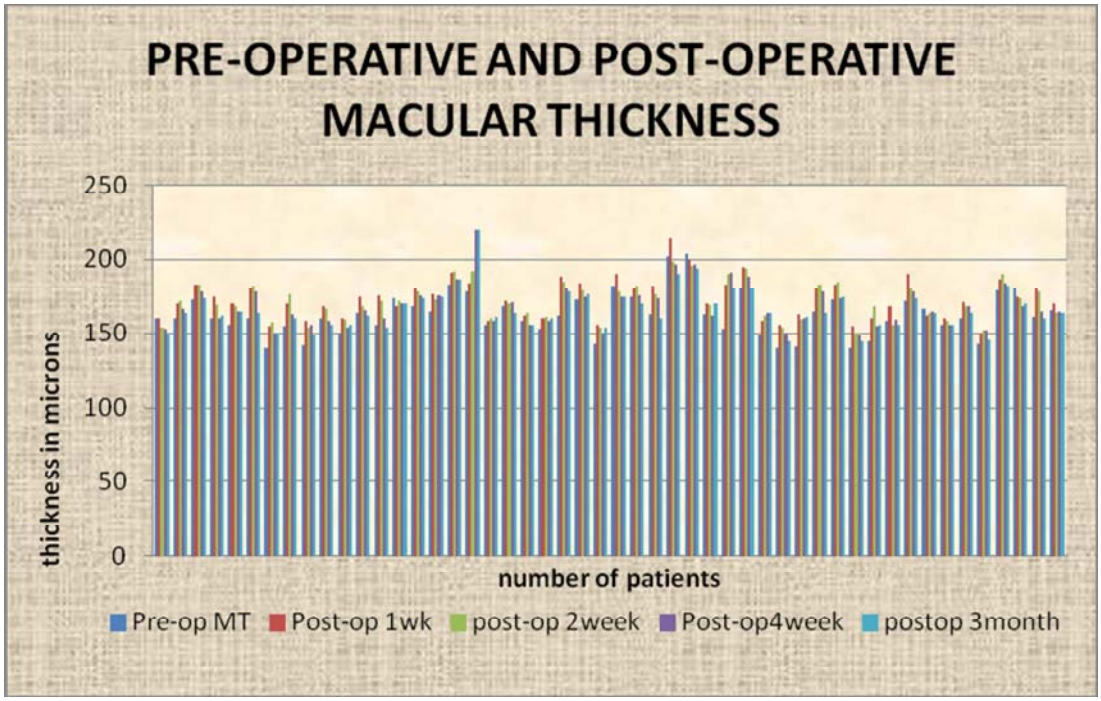


Figure 7b. Preoperative and post-operative mean macular thickness in 50 patients who underwent cataract surgery

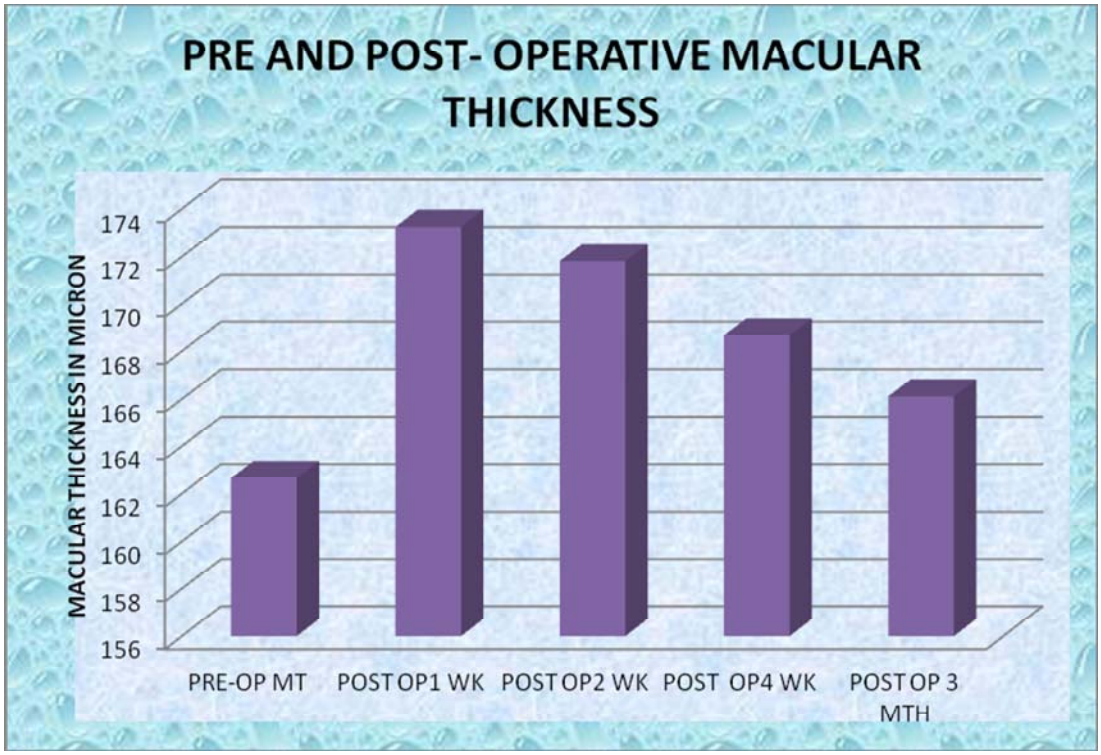


Figure 8a. Preoperative and post-operative macular thickness in 25 patients who underwent small incision cataract surgery

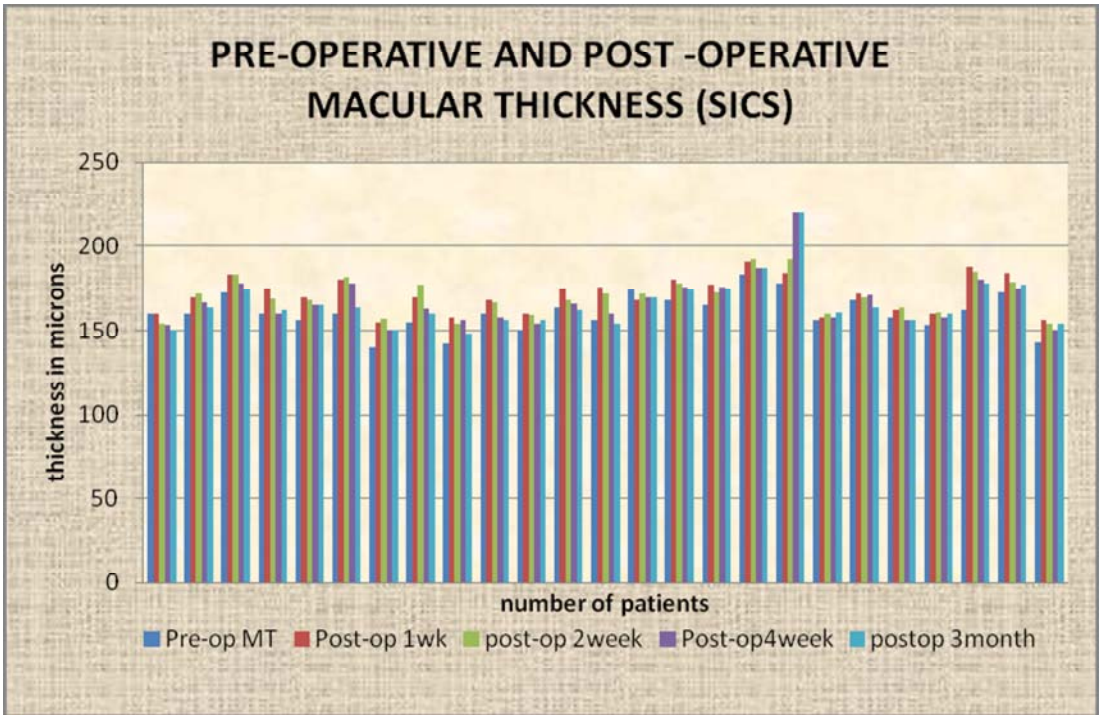


Figure 8b. Preoperative and postoperative mean macular thickness in 25 patients who underwent small incision cataract surgery

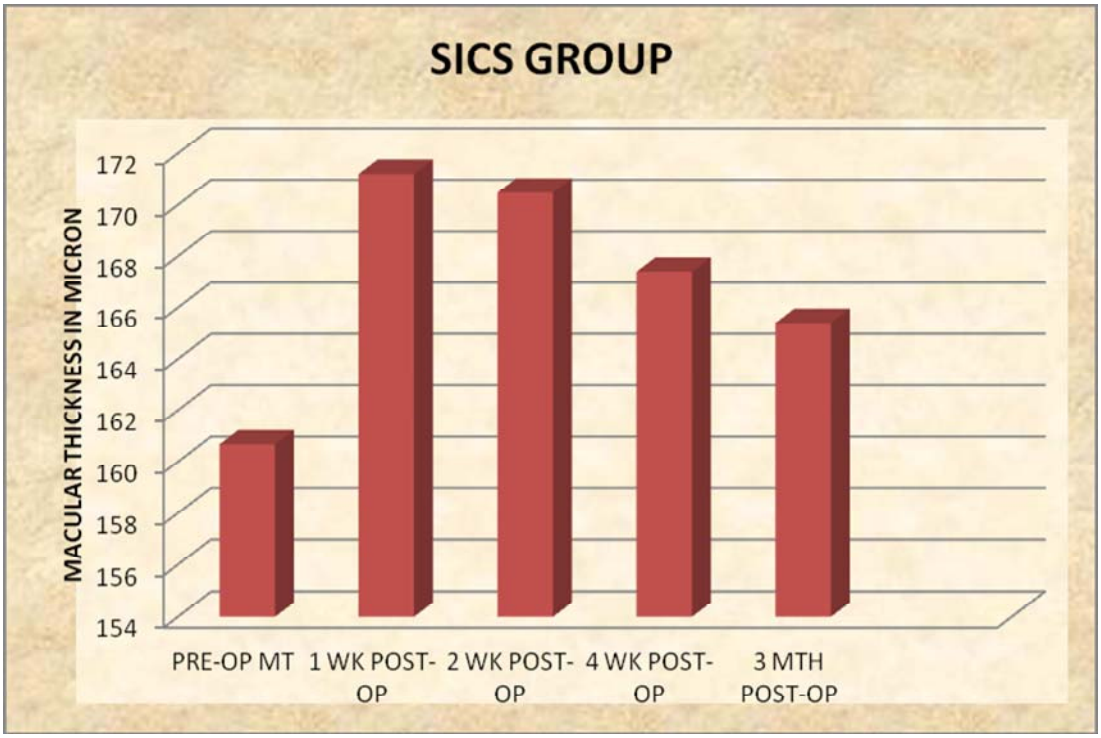


Figure 9a. Preoperative and post-operative macular thickness in 25 patients who underwent phacoemulsification cataract surgery

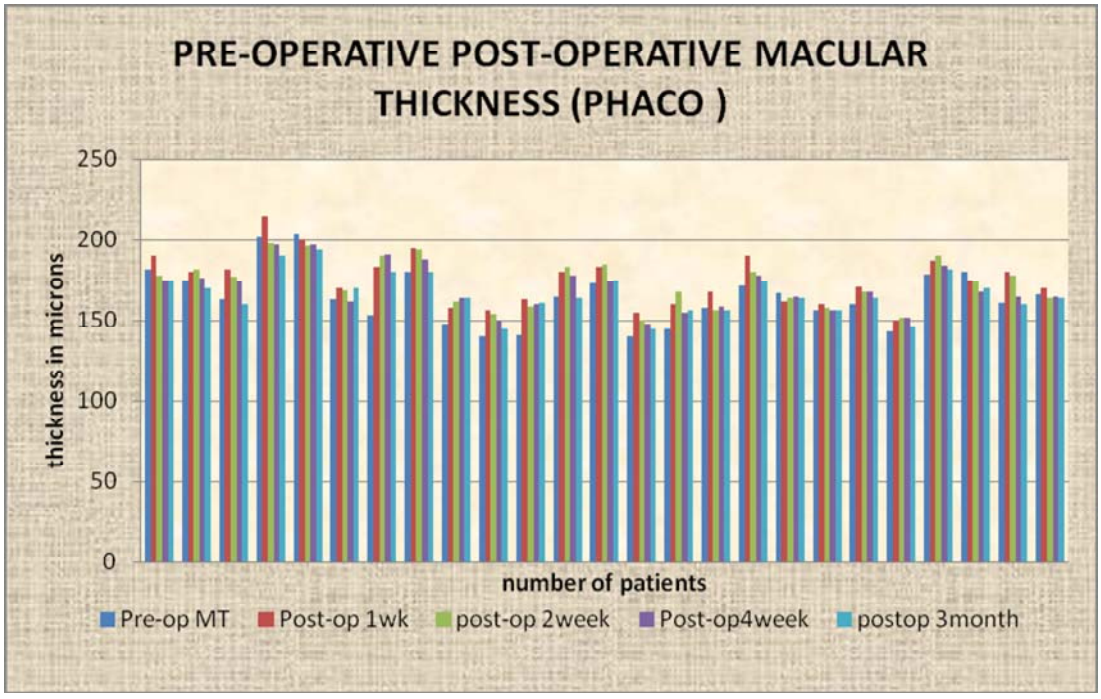


Figure 9b. Preoperative and post-operative mean macular thickness in 25 patients who underwent phacoemulsification

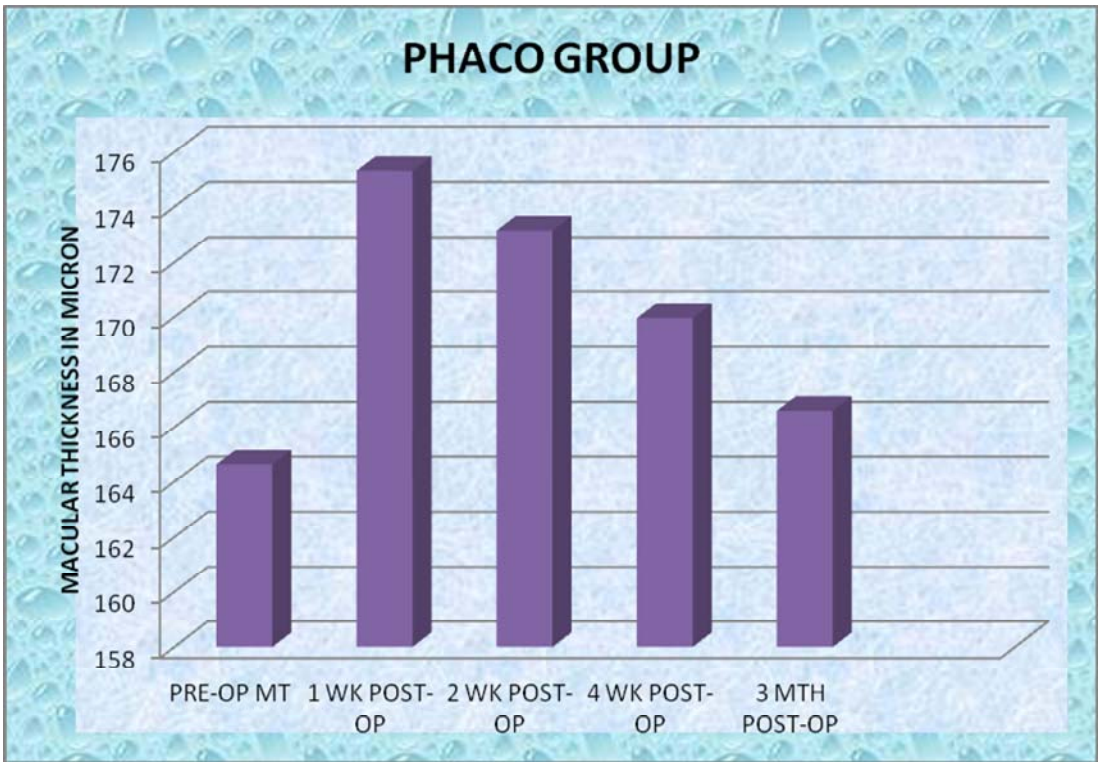


Figure 10. A comparison of preoperative and postoperative mean macular thickness in patients who underwent small incision cataract surgery and patients who underwent phacoemulsification cataract surgery

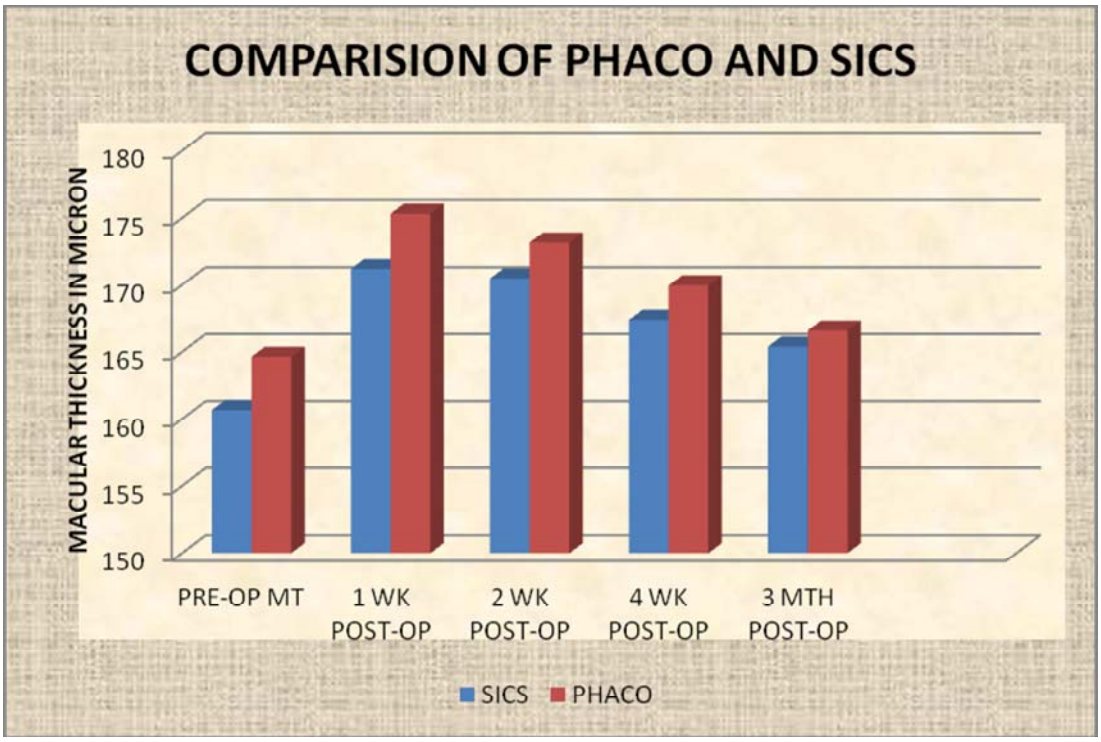


Figure 11a. OCT picture shows the preoperative macular area with thickness of 152 microns.

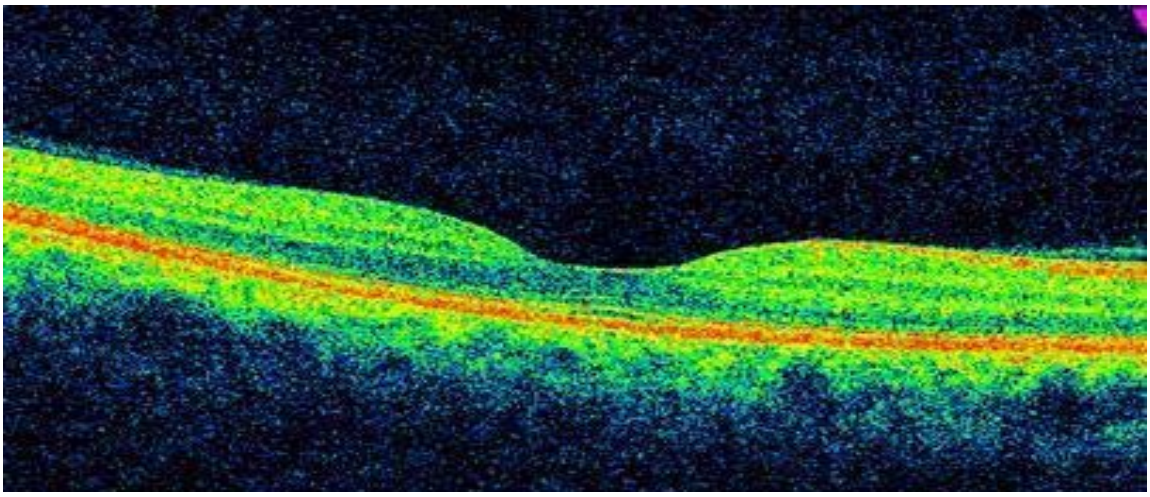
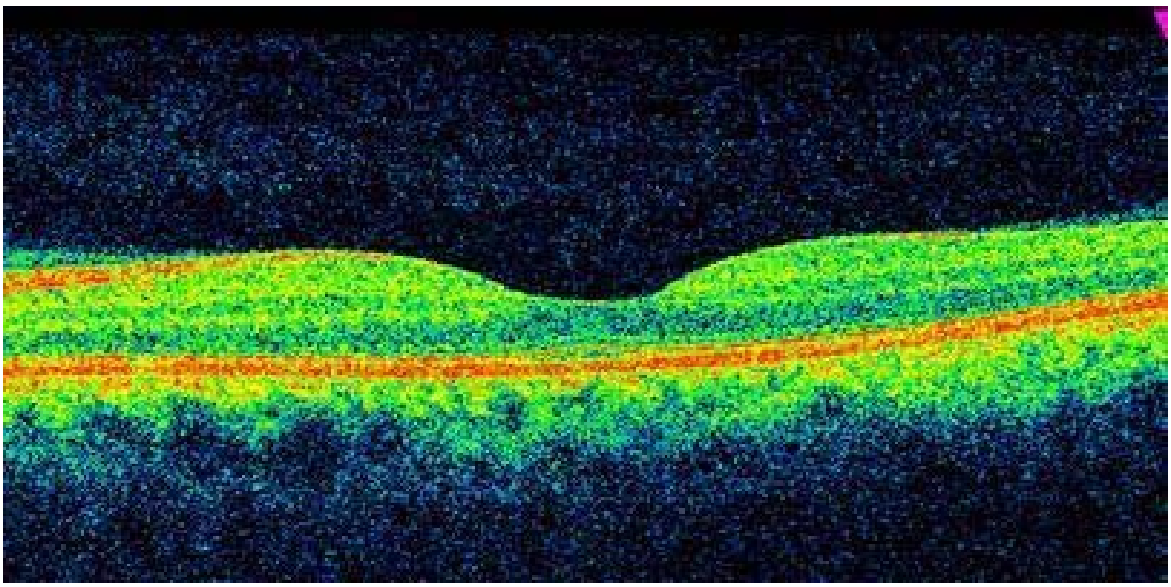


Figure 11b. OCT picture shows the postoperative subclinical macular edema with thickness of 184 microns.



DISCUSSION

Following cataract surgery, subclinical changes may occur in macular thickness without the visual acuity being affected. However, pseudophakic cystoid macular edema (PCME) is a known complication of cataract and intraocular lens (IOL) surgery, manifesting as effusion of fluid from the capillaries. Although this phenomenon is most often self-limiting, culminating in spontaneous resolution, it occasionally leads to marked impairment of central vision, which may become chronic or permanent. In the present investigation, on which this dissertation is based, an attempt was made to determine putative alterations in best corrected visual acuity (BCVA) and macular thickness in two groups of patients, namely, those undergoing small incision cataract surgeries (SICS) and those undergoing phacoemulsification cataract surgery.

Sambuddha Ghosh et al.[29] performed a prospective, randomized comparative study of macular thickness following phacoemulsification cataract surgery and that following SICs. The mean age of the patients was 62 ± 6 years and 61 ± 6 years in the SICS and phacoemulsification groups, respectively. Males accounted for 58% of patients in the SICS

group and for 53.5% of patients in the phacoemulsification group. There was no significant difference in age or gender between the two groups. The right eye was operated on in 49.1% of patients in the SICS group and in 50.9% of patients in the phacoemulsification group, the difference not being statistically significant[29].

In the present investigation, results similar to those of Ghosh et al[29] were noted. The mean age of the 25 patients who underwent the SICS procedure was 57.04 ± 8.05 [95% C.I.= 53.72 to 60.36] years while the mean age of the patients who underwent the phacoemulsification procedure was 59.68 ± 12.05 [95 % C.I.= 54.71 to 64.65] years ; this difference was not statistically significant (`t' test [degree of freedom {d.f.}=48] = 0.9110 ; P = 0.37). In the SICS group, there were 10 males and 15 females while in the phacoemulsification group, there were 12 males and 13 females; this difference was also not statistically significant (λ_2 (d.f.=1)= 0.38; P > 0.05).The right eye was operated on in 25 of the 50 patients while the left eye was operated on in the other 25 patients. In the SICs group, the right eye was operated on in 11 patients and the left eye was operated on in 14 patients, while in the phacoemulsification group, the right eye was operated on in 14 patients and the left eye was operated on in 11 patients; this difference was not statistically significant (λ_2 (d.f.=1)=

0.72; P > 0.05). The present study, as well as the study by Ghosh et al.[29], appear hitherto to be the only studies that have compared macular thickness changes after uneventful SICS and phacoemulsification cataract surgery.

Nakayama et al[27]. reported that , following cataract surgery, macular thickening and an increase in aqueous flare and cells were marked in diabetic eyes In non diabetic patients, these subtle changes improved gradually and returned to near normal within 6 months; however, in diabetic patients , prolonged and progressive macular thickening was observed 6 months after surgery with decreased visual acuity due to macular oedema. Considering these possible confounding factors, in the present investigation, diabetic patients were excluded from the study. This is one of the original aspects of the present investigation.

In the present study, 43 (86 %) of the 50 patients did not have any systemic illness. Seven (14%) of the 50 patients suffered from hypertension; one of these hypertensive patients underwent SICs while the other six hypertensive patients underwent phacoemulsification.

Jurecka et al[28] noted that there was a positive statistical correlation between the real phacoemulsification time and the increase in macular volume and retinal thickness in the fovea and the inner macular area in the first week and in the first and second months following surgery). Moreover, a positive statistical correlation was found between the overall duration of the surgical procedure and the increase in the macular volume and retinal thickness in all areas one month after surgery

In the present investigation, overall in the 50 patients, the mean surgical time was 10.16 ± 1.04 (95 % C.I. =9.87 to 10.45) minutes. In the 25 patients who underwent SICS, the mean surgical time was 10.0 ± 0.87 (95 % C.I.= 9.64 to 10.36) minutes , which was less than the mean surgical time (10.32 ± 1.18 [95 % C.I. = 9.83 to 10.81]) minutes in the 25 patients who underwent phacoemulsification ; however, this difference was not statistically significant (`t' [d.f.= 48]= 1.09 ; P=0.28) . In the 25 patients who underwent phacoemulsification, the mean phacoemulsification time was 1.28 ± 0.4 minutes. In the present study, there was no positive correlation between the increase in retinal thickness and the real phacoemulsification time, or between the increase in retinal thickness and the overall duration of the surgical procedure.

Von Jagow et al[23]. Found no correlation between macular thickening and visual acuity and selected surgical and biometrical parameters. Surgical and biometric parameters, such as phacoemulsification time and energy and axial length, did not correlate with the degree of macular thickness. In the present investigation also, the phacoemulsification time, energy and axial length did not correlate with changes in the macular thickness.

In studies by Gogate et al[30]; Ruit et al[31] and Sambuddha Ghosh et al[29]. the visual outcome was identical with the six month follow up. In the current study, the visual acuity was identical in all the reviews, up to the third month.

In the studies by Polito et al[32] and Danis et al[33], the `fast macular thickness' map protocol was used widely in measuring the macular thickness, which provided good repeatability and reproducibility. In the present investigation, , the `fast macular thickness' map protocol was used for measuring macular thickness.

In the study by Sambuddha Ghosh et al[29], the first post-operative day macular thickness was used as the baseline macular thickness value.

However, in the present investigation, the pre- operative macular thickness reading was considered to be the baseline value.

Sourdille et al[22]. Evaluated changes in macular thickness following uneventful cataract surgery by using OCT, and compared the OCT findings with those of flare and cells. Although some postoperative increase in macular thickness was noted in 11 eyes, this was not related to a higher postoperative flare; moreover, visual consequences were proportionate to the macular thickness. In the present investigation, patients with a high level of flare and with corneal edema were excluded from the study.

Brio et al[24]. Studied changes in foveal and perifoveal thickness as determined by OCT; after phacoemulsification cataract surgery with IOL implantation. These authors noted a significant change in the macular thickness on post operative days 1, 30, and 60, in the perifoveal 3.0 and 6.0 mm sectors, either calculated alone or averaged together with the foveal values. The initial preoperative mean value of 234.1± 2.6 microns (mean ± SEM, n=536) in the 6.0mm perifoveal region increased to 242.5±2.6 microns (mean± SEM, n=488,p=<0.05) at one week, to 247.7±4.6 microns (n=352, p<0.01) at one month, and to 246.0± 5.9 microns (n=208, p<0.05) at two months after surgery, which proved to be significant. However, the

relative change in the macular thickness, namely 3.5, 5.6, and 5.3% at the above periods, respectively, was moderate.

In the current study, similar changes were noted in the phacoemulsification cataract surgery group (25 patients). The pre-operative macular thickness was 172±32μ while the mean value was 164.64 ± 17.51 (95 % C.I. = 157.41 to 171.87) μ. At the first week review, the macular thickness had increased to 182 ± 32 μ , with a mean macular thickness of 175.32μ ± 15.84 (95% C.I.=168.78 to 181.86) μ. At the second week review, the macular thickness was 175±25μ and the mean macular thickness was 173.16μ ± 14.44 (95 % C.I.=167.72 to 179.12) μ, while at the fourth week review, the macular thickness was 172±20μ and the mean macular thickness was 169.96μ ± 13.95 (95% C.I.=164.2 to 175.72) μ. At the final review (third month post-surgery), the macular thickness was 169 ± 24 μ and the mean macular thickness was 166.6 ± 12.86 (95% C.I.=161.29 to 171.91) μ. When differences between these five mean values were subjected to statistical analysis by one-way ANOVA, they were found not statistically significant. When post-hoc testing was done, significant ($P<0.05$) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the postoperative 1st week mean value and the post-operative 4th week

mean value of macular thickness. In the 25 patients who underwent phacoemulsification in the present investigation, there was a significant subclinical change in the macular thickness at the first week follow- up without, however, the visual acuity being affected.

Sambuddha Ghosh et al.[29] performed a prospective randomized comparative study of macular thickness following phacoemulsification cataract surgery and that following SICS. On the first postoperative day, the central subfield mean thickness (CSMT) in the SICS group (192.8 ± 17.9 μm) was not significantly different from that in the phacoemulsification group (192.1 ± 27.4 μm). However, on the 7th day, the CSMT in the SICS group (198.9 ± 21.4μm) was significantly greater than that in the phacoemulsification group (193.1 ±19.3μm). Again, on the 42nd day, the CSMT in the SICS group (207.8± 26.3 μm) significantly exceeded that in the phacoemulsification group (198.3 ± 23μm). The increase in macular thickness was sub-clinical and did not affect final visual outcome in any patient.

In the present investigation, findings that were similar to those of Ghosh et al. were noted. When both the groups (patients who had undergone SICS and those who had undergone phacoemulsification cataract surgery) were compared, a prolonged subclinical macular oedema

was noted up to the fourth week review in the SICS group whereas in the patients who had undergone phacoemulsification, the macular thickness was found to be increased up to the second week review. However, differences between the two groups in the mean macular thickness values noted preoperatively and at 1 week, 2 weeks, 4 weeks and 3 months postoperatively were not statistically significant

Mentes et al[34], Biro et al[24] and Sambuddha Ghosh et al[29] did not observe clinical macular odema in their study population. Similarly, in the present study, cystoid macular edema was not noted in any of the patients.

One of the limitations of the present study was the relatively short post-operative duration over which patients came for review. An important reason for this was that, in the absence of notable complications, patients felt it was not necessary to present for review. It is possible that if the follow-up period had been longer, the results may have been different. Another limitation of the study is that the number of patients ultimately enrolled in the two study groups were less than that calculated for the sample size. Future studies are required to confirm the initial results of the present investigation. In these future studies, a larger number of patients should be enrolled and the study period should be extended.

CONCLUSIONS

- Subclinical macular edema occurs after uncomplicated cataract surgery with a peak at 1 week after surgery and can last for up to 4 weeks.
- OCT showed macular edema without altering the architecture of the macula.
- The duration of the subclinical edema is longer in eyes undergoing manual SICS as compared to those undergoing phacoemulsification.
- There is no effect of this edema on visual acuity.

SUMMARY

Following cataract surgery, subclinical changes may occur in macular thickness without the visual acuity being affected. Although pseudophakic cystoid macular edema (PCME) may occur, this is most often self-limiting, culminating in spontaneous resolution, although there is occasionally marked impairment of central vision. In the present investigation, conducted at a tertiary eye care facility in southern India over a period of 12 months, an attempt was made to determine putative alterations in best corrected visual acuity (BCVA) and macular thickness in two groups of patients, namely, those undergoing small incision cataract surgeries (SICS) and those undergoing phacoemulsification cataract surgery.

Based on defined inclusion and exclusion criteria, 50 individuals (28 [56%] males and 22[54%] females) were enrolled in the study. Of these, 25 (50% of total) individuals underwent SICS in one eye with “in the bag” polymethacrylate intraocular lens (PMMA IOL) implantation, while the other 25 (50% of total) individuals underwent phacoemulsification in one eye with “in the bag” acrylic type of foldable IOL. The mean age of the 25 patients who underwent the SICS procedure

(57.04 ± 8.05 years) was not significantly different from that of the 25 patients who underwent the phacoemulsification procedure (59.68 ± 12.05 years). In the SICS group, there were 10 males and 15 females while in the phacoemulsification group, there were 12 males and 13 females (difference not statistically significant).

Forty-three (86 %) of the 50 patients did not have any systemic illness. Seven (14%) of the 50 patients suffered from hypertension; one of these hypertensive patients underwent SICS while the other six hypertensive patients underwent phacoemulsification. The right eye was operated on in 25 of the 50 patients while the left eye was operated on in the other 25 patients. In the SICs group, the right eye was operated on in 11 patients and the left eye was operated on in 14 patients, while in the phacoemulsification group, the right eye was operated on in 14 patients and the left eye was operated on in 11 patients; this difference was not statistically significant.

Overall, in the 50 patients, the mean surgical time was 10.16 ± 1.04 minutes. In the 25 patients who underwent SICS, the mean surgical time was 10.0 ± 0.87 minutes which was not significantly different from the mean surgical time (10.32 ± 1.18 minutes) in the 25 patients who

underwent phacoemulsification In the 25 patients who underwent phacoemulsification, the mean phacoemulsification time was 1.28 ± 0.4 minutes.

In the 50 patients, the mean pre–operative visual acuity was 0.31 ± 0.2 decimals (approximately 6/18p), which showed a significant improvement following surgery to a mean value of 0.68 ± 0.2 decimals (approximately 6/9). Similarly, in the 25 patients who underwent SICS, the mean pre-operative visual acuity (0.21 ± 0.15 decimals [approximately 6/36p]) showed a significant improvement following surgery to a mean value of 0.65 ± 0.17 decimals (approximately 6/9) while in the 25 patients who underwent phacoemulsification cataract surgery, the mean pre-operative visual acuity (0.40 ± 0.17 decimals) also exhibited a significant improvement to a mean postoperative visual acuity of 0.70 ± 0.17 decimals (approximately 6/6p).

Interestingly, the mean pre-operative visual acuity (0.21 ± 0.15 decimals) in the 25 patients who underwent SICS was significantly less than that (0.40 ± 0.17 decimals) in the 25 patients who underwent phacoemulsification whereas there was no significant difference between the two groups in the mean post-operative visual acuity.

In the 50 patients who underwent cataract surgery, the pre-operative macular thickness noted was 172±27μ. The mean pre-operative macular thickness was 162.66 ± 14.53 while post- operatively at the first week review, the macular thickness was found to have increased to 183±31 μ, with a mean value of 173.26 μ ± 13.51 μ; at the second week review, the macular thickness was 178±23μ and the mean macular thickness was 171.82μ ± 12.86 μ; at the fourth week review, the macular thickness was 184 ± 32μ and the mean macular thickness was 168.68 μ ± 14.41μ; at the third month review, the macular thickness was 184±31 μ and the mean macular thickness was 166.12 ± 13.85 μ.

Statistical analysis revealed that the differences between these five mean values were significant. Highly significant ($P<0.01$) or significant ($P<0.05$) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2ndt week mean value, and the preoperative mean value and the post-operative 4th week mean value, between the post-operative 1st week mean value and the post-operative 3rd month mean value, and the post-operative 2nd week mean value and the post-operative 3rd month mean value of macular thickness. In the 50 patients, subclinical macular oedema was noted at the first, second and fourth week reviews; while the peak

subclinical macular odema was noted at the first week review, at the third month review, the macular edema had reduced

The baseline (preoperative) macular thickness noted in the 25 patients who underwent SICS was 163±20μ while the mean thickness was 160.68μ ± 10.78 a). At the post-operative first week review, the macular thickness was 175±18μ and the mean macular thickness was 171.2 μ ± 10.63; at the post-operative second week review, the macular thickness was 170 ± 15 μ and the mean macular thickness was 170.48 μ ± 11.2 μ; at the post-operative fourth week review, the macular thickness was 180 ± 30μ and the mean macular thickness was 167.4 μ ± 15.02 μ; at the post-operative third month review, the macular thickness was 180 ± 30 μ and the mean macular thickness was 165.64 ± 15.01 μ. Statistical analysis (one-way ANOVA) of the differences between these 5 mean values revealed significant differences. Post-hoc testing revealed highly significant ($P<0.01$) or significant ($P<0.05$) differences between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the preoperative mean value and the post-operative 4th week mean value of macular thickness. In the 25 patients who underwent SICS, subclinical macular edema was noted at the first, second and fourth week reviews.

In the 25 patients who underwent phacoemulsification cataract surgery, the pre-operative macular thickness was 172±32μ while the mean value was 164.64 ± 17.51 (95 % C.I. = 157.41 to 171.87) μ. At the first week review, the macular thickness had increased to 182 ± 32 μ , with a mean macular thickness of 175.32μ ± 15.84 (95% C.I.=168.78 to 181.86) μ. At the second week review, the macular thickness was 175±25μ and the mean macular thickness was 173.16μ ± 14.44 (95 % C.I.=167.72 to 179.12) μ, while at the fourth week review, the macular thickness was 172±20μ and the mean macular thickness was 169.96μ ± 13.95 (95% C.I.=164.2 to 175.72) μ. At the final review (third month post-surgery), the macular thickness was 169 ± 24 μ and the mean macular thickness was 166.6 ± 12.86 (95% C.I.=161.29 to 171.91) μ. When differences between these five mean values were subjected to statistical analysis by one-way ANOVA, they were found not statistically significant. When post-hoc testing was done, significant ($P<0.05$) differences were noted between the preoperative mean value and the post-operative 1st week mean value , preoperative mean value and the post-operative 2nd week mean value, and the postoperative 1st week mean value and the post-operative 4th week mean value of macular thickness. In the 25 patients who underwent phacoemulsification in the present investigation, there was a significant

subclinical change in the macular thickness at the first week follow- up without, however, the visual acuity being affected.

When both the groups (patients who had undergone SICS and those who had undergone phacoemulsification cataract surgery) were compared, a prolonged subclinical macular oedema was noted up to the fourth week review in the SICS group whereas in the patients who had undergone phacoemulsification, the macular thickness was found to be increased up to the second week review. However, differences between the two groups in the mean macular thickness values noted preoperatively and at 1 week, 2 weeks, 4 weeks and 3 months postoperatively were not statistically significant.

Cystoid macular edema was not noted in any of the patients in the current study.

One of the limitations of the present study was the relatively short post-operative duration over which patients came for review. An important reason for this was that, in the absence of notable complications, patients felt it was not necessary to present for review. It is possible that if the follow-up period had been longer, the results may have been different.

Another limitation of the study is that the number of patients ultimately enrolled in the two study groups were less than that calculated for the sample size. Future studies are required to confirm the initial results of the present investigation. In these future studies, a larger number of patients should be enrolled and the study period should be extended.

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JOSEPH EYE HOSPITAL

TIRUCHIRAPALLI

NAME : **AGE :** **SEX :** **S:NO :**

ADDRESS : **M.R.NO :**

PHONE :

COMPLAINTS :

PERSONAL HISTORY :
DIABETES :
HYPERTENSION :
DYSLIPEDEMIA :
CARDIAC STATUS :
FAMILY HISTORY :
TREATMENT HISTORY :

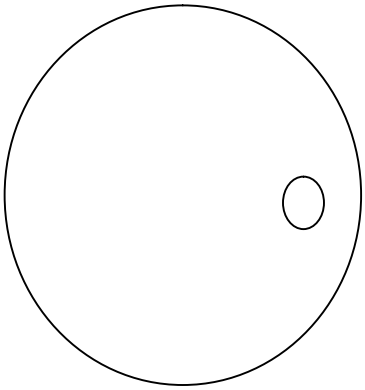
GENERAL EXAMINATION :	
B.P	URINE : ALBUMIN : SUGAR :
PULSE RATE	RBS :
CVS	

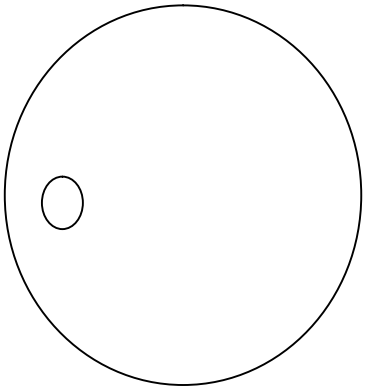
OCULAR EXAMINATION		RE	LE
VISION	Distant vision Without correction Best corrected		
	Near vision Without correction Best corrected		
IOP BE DUCT			
ANTERIOR SEGMENT			
	Lids and Adnexa		
	Conjuctiva		
	Cornea		
	AC		
	IRIS		
	Pupil		
	lens		

POSTERIOR SEGMENT – FUNDUS : RE LE

Media			
Disc			
	Colour		
	Margins		
	CD ratio		
	Neuroretinal rim		
	vessels		
Macula			
Others			
Provisional diagnosis			
RE			
LE			

Fundus photograph





A – Scan

OCT

Details of Surgery:

Duration of surgery:

FOLLOW UP

Duration	BCVA	S/L	OCT	Others
1 week				
2 week				
4 week				
3 month				

SICS GROUP

Sl No	Name	IP No	Age	Sex	Eye	Asso.disease	Surgery type	fundus	Pre-op MT	Post-op 1wk	post-op 2week	Post-op4week	postop 3month	Pre op vision	post op vision	surgical time SICS
1	Mary rani	770040	55	F	LE	Nil	SICS LE	NAD	160	160	154	153	150	0.5	0.6	11
2	sheba	847547	33	F	LE	Nil	SICS LE	NAD	160	170	172	167	164	0.1	0.6	12
3	chellakuty	824448	60	F	RE	NIL	SICS RE	NAD	173	183	183	178	174	0.5	0.6	11
4	sagunthala	845508	57	F	RE	NIL	SICS RE	NAD	160	175	169	160	162	0.5	1	10
5	chidambaram	836693	65	M	RE	NIL	SICS RE	NAD	156	170	168	165	165	0.1	0.8	9
6	parimanan	847525	62	M	LE	NIL	SICS LE	NAD	160	180	182	178	164	0.17	0.6	9
7	chellam	845480	55	F	LE	NIL	SICS LE	NAD	140	155	157	150	150	0.1	0.5	10
8	kamallam	845483	54	M	LE	NIL	SICS LE	NAD	155	170	177	163	160	0.08	0.6	10
9	amirtham	845509	59	F	LE	NIL	SICS LE	NAD	142	158	154	156	148	0.25	0.6	9
10	jesurathinam	847513	56	M	RE	NIL	SICS RE	NAD	160	168	167	158	156	0.1	0.6	10
11	velamkanni	837650	67	M	RE	NIL	SICS RE	NAD	150	160	159	154	156	0.08	0.6	9
12	gloriya	848660	68	M	LE	NIL	SICS LE	NAD	164	175	168	166	162	0.1	0.6	11
13	sarada	848679	60	F	RE	NIL	SICS RE	NAD	156	176	172	160	154	0.17	1	10
14	mariyasusai	850770	65	F	LE	NIL	SICS LE	NAD	174	168	172	170	170	0.1	0.6	9
15	rajamani	837154	60	F	RE	NIL	SICS RE	NAD	168	180	178	176	174	0.17	0.8	11
16	arokiyam	847084	60	F	RE	HT	SICS RE	NAD	165	177	173	176	175	0.32	0.6	10
17	manjaee	849936	52	M	RE	NIL	SICS RE	NAD	183	191	192	187	187	0.1	0.6	9
18	chellakuty	824448	60	F	LE	NIL	SICS LE	NAD	178	184	192	220	220	0.5	0.25	9
19	kannama	842133	41	F	LE	NIL	SICSLE	NAD	156	158	160	158	161	0.25	0.6	10
20	stephen	818699	56	M	LE	NIL	SICSLE	NAD	168	172	170	171	164	0.25	0.6	9
21	chinnaponu	830228	46	F	RE	NIL	SICSRE	NAD	158	162	164	156	156	0.08	0.6	10
22	stephen	818699	56	M	RE	NIL	SICSRE	NAD	153	160	161	158	160	0.17	1	11
23	velamkani	837650	67	M	LE	NIL	SICS LE	NAD	162	188	185	180	178	0.08	0.6	11
24	rajamani	837154	60	F	LE	NIL	SICS LE	NAD	173	184	179	175	177	0.32	0.8	10
25	manjaee	849936	52	F	LE	NIL	SICS LE	NAD	143	156	154	150	154	0.25	0.6	10

PHACO Group

Sl No	Name	IP No	Age	Sex	Eye	Asso.disease	Surgery type	fundus	Pre-op MT	Post-op 1wk	post-op 2week	Post-op4week	postop 3month	Pre op vision	Post op vision	surgical time phaco	phaco time
1	Saraswathy	827678	60	F	RE	Nil	Phaco RE	NAD	182	190	178	175	175	0.5	1	10	1
2	Antonyammal	819574	75	F	RE	HT	Phaco RE	NAD	175	180	182	176	170	0.6	0.6	12	2
3	Tamilselvi	818075	40	F	LE	Nil	Phaco LE	NAD	163	182	177	174	160	0.5	0.6	9	1
4	Geetha	825338	51	F	LE	NIL	Phaco LE	NAD	202	215	198	197	190	0.5	0.8	9	2
5	Pitchaipillai	829253	51	M	RE	Nil	Phaco RE	NAD	204	200	196	197	194	0.6	0.8	11	1
6	Vembu	830846	40	F	RE	Nil	Phaco RE	NAD	163	170	169	162	170	0.32	0.6	10	1.5
7	Palanivel	830514	64	M	LE	Nil	Phaco LE	NAD	153	183	190	191	180	0.5	0.6	11	2
8	Narayanasamy	822673	78	M	RE	HT	Phaco RE	NAD	180	195	194	188	180	0.32	1	10	1.3
9	Phyllis	783111	69	F	RE	Nil	Phaco RE	NAD	148	158	162	164	164	0.5	1	12	1.2
10	Regana Begam	836808	57	F	RE	HT	Phaco RE	NAD	140	156	154	150	145	0.6	0.6	11	1.3
11	Motchamary	811294	55	F	RE	HT	Phaco RE	NAD	141	163	159	160	161	0.5	0.6	10	1
12	Ganthimathy	837942	45	F	LE	Nil	Phaco LE	NAD	165	180	183	178	164	0.25	0.8	9	1.4
13	masilamani	849294	61	M	RE	Nil	phaco RE	NAD	173	183	185	174	175	0.6	0.6	9	1
14	durai murgan	842024	35	M	LE	NIL	phacoLE	NAD	140	155	150	148	145	0.1	0.6	11	2
15	boopathi	845069	55	M	LE	NIL	phacoLE	NAD	145	160	168	155	156	0.1	0.6	12	1
16	ponnurangam	832168	65	F	RE	NIL	phaco RE	NAD	158	168	156	159	156	0.5	0.5	9	1
17	anbunasen	734071	73	M	RE	NIL	phaco RE	NAD	172	190	180	178	174	0.5	0.8	9	1
18	ganesamoorth	842143	62	M	LE	NIL	PhacoLE	NAD	167	162	164	165	164	0.1	0.5	13	1.3
19	thayagam	827693	61	M	RE	NIL	phacoRE	NAD	156	160	158	156	156	0.25	0.5	9	1
20	sudakar	813248	55	M	RE	NIL	phacoRE	NAD	160	171	168	168	164	0.17	0.6	11	1.5
21	kalaiselvi	826528	55	F	LE	NIL	Phaco LE	NAD	143	150	152	152	146	0.32	0.8	9	1
22	anbunasen	734071	73	M	LE	NIL	phacoLE	NAD	179	187	190	184	182	0.5	1	10	1
23	Antonyammal	819574	75	F	LE	HT	Phaco LE	NAD	180	175	174	168	170	0.6	0.8	11	1.3
24	Narayanasamy	822673	78	M	LE	HT	Phaco LE	NAD	161	180	178	165	160	0.32	0.6	10	1.2
25	pakiyam	826422	59	F	RE	NIL	PhacoRE	NAD	166	170	164	165	164	0.32	0.6	11	1